Little Fish Lake Resource Assessment

For Ecological Reserves Planning In Alberta

Alberta

ENERGY AND
NATURAL RESOURCES
Public Lands Division

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LITTLE FISH LAKE RESOURCE ASSESSMENT

For Ecological Reserves Planning

in Alberta

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ABSTRACT

This report provides a summary of the botanical and wildlife studies conducted in 1984 in the remnant northern fescue grasslands of the Little Fish Lake Area of southern Alberta. Vegetation descriptions are provided for both special and representative types. Wildlife is described according to habitat types. Annotated lists and analyses of the flora and wildlife are included. There is also a discussion of the effects of various land uses on the grasslands at Little Fish Lake.

TABLE OF CONTENTS

		Page
1.	INTRODUCTION	1
2.	CLIMATE	3
3.	LANDSCAPE, SOILS AND LAND USE	4
	3.1 Topography and Hydrology	4
	3.2 Bedrock Geology	4
	3.3 Surficial Geology	5
	3.4 Soils	5
	3.5 Land Use and Disturbance	6
4.	VEGETATION	7
	4.1 Fescue Grassland	7
	4.2 Mixed Grassland	9
	4.3 Aspen Woodland	11
	4.4 Shrub Communities	12
	4.4.1 Rose-Buckbrush	13
	4.4.2 Buffaloberry	13
	4.4.3 Moist Tall Shrub	14
	4.4.4 Silverberry	15
	4.5 Badlands	15
	4.6 Alkaline Seepage Springs	15
	4.7 Wetlands	16
5.	WILDLIFE	18
	5.1 Grassland	18
	5.2 Low Shrubbery	19
	5.3 Tall Shrubbery	19
	5.4 Woodland	20
	5.5 Wetlands	20
	5.6 Badlands	21

6. ANALYSIS 22

6.1 Vegetation 22
6.2 Wildlife 23
6.3 Significant Features 24
6.3.1 Vegetation 25
6.3.2 Wildlife 25

7. MANAGEMENT 32

7.1 Effects of Grazing and Mowing on Vegetation 32
7.2 Effects of Grazing and Mowing on Wildlife 33
7.3 Current Range Condition 34
7.4 Management Approaches 35
7.4.1 Grazing and Mowing Philosophies 35
7.4.2 Grazing Systems 37
7.5 Conclusion 37

APPENDICES

1: ANNOTATED LIST OF FLORA 39

2: ANNOTATED LIST OF MAMMALS 49

3: ANNOTATED LIST OF BIRDS 50

4: ANNOTATED LIST OF REPTILES AND AMPHIBIANS 56

5: 1984 LITTLE FISH LAKE PLANT COLLECTIONS 57

6: FIELD NOTES 62

7: TERMS OF REFERENCE 72

LIST OF REFERENCES 77

LIST OF MAPS

Map		Page
1.	Range Condition, Improvements	29
2.	Special Features, Plot Locations	31

1. INTRODUCTION

This report summarizes the findings of 1984 field research conducted on the vegetation and wildlife in the Little Fish Lake area of the Northern Fescue section of the Grassland natural region. In addition, a general overview of the area's geology, climate, topography and hydrology is provided based on published literature.

The Grassland region occupies much of southern Alberta; however, only a narrow strip of fescue grassland exists between the more extensive Mixed Grassland to the south and wooded natural regions to the north and west. This narrow strip itself is divided into two very distinct sections -- Northern Fescue and Foothills. The Foothills Grassland is dominated by rough and Idaho fescues and by Parry's and intermediate oat grasses. The Foothills Grassland typically has more forbs than Northern Fescue Grassland.

The Northern Fescue Grassland is dominated by rough fescue. Most of this region has been converted into agricultural cropland because of the high productivity of the soils. The remaining "natural" sites occur mainly on strongly hummocky moraine or on Solonetzic soils. Little Fish Lake contains a diverse flora and fauna representative of the Northern Fescue Grassland.

The Little Fish Lake study area includes all of Township 28, Range 17, West of the Fourth Meridian, except Sections 4 to 9 inclusive. Prior to the field season, aerial photographs of the area were studied and key resources were identified for further examination.

Unfortunately, the drought during the growing season so severely limited plant growth that extensive or intensive plot work would have had little value. It was decided to spend most of the study effort evaluating the effects of past and recent grazing and mowing in each quarter section. This was accomplished by inspection of sites in every quarter section and visually estimating the condition of the range in two classes for mowed areas (good and excellent) and four classes for grazed areas (light, moderate, heavy, and extremely heavy). Descriptions of these classes can be found on Map 1 - Range Condition, Improvements. The 1984 range condition information was compared to data in field notes from previous unpublished research by C. Wallis and C. Wershler.

Some vegetation plots were sampled. These were 5 m^2 circular plots for which visual estimates of cover were recorded. These were sampled primarily to give some indication of the diversity of plants from site to site. They were surveyed in August following a period of rain. The plant growth was remarkable considering the length of the drought that preceded the rain.

Notes on flora and wildlife were also kept. These are summarized in the discussions and annotated lists. The results of unpublished field notes from studies in other years by C. Wallis, C.

Wershler, and W. Smith are summarized in appropriate portions of the report.

2. CLIMATE

The nearest weather station for which climatic data is available is Craigmyle, located approximately 30 km north of the study area. This station has been open since 1961. Craigmyle is at a lower elevation than the study area which is, therefore, probably moister and cooler.

The mean daily temperature varies from a January maximum and minimum of -9.8°C and -19.7°C in to a July maximum and minimum of 25.0°C and 9.7°C. The extreme maximum temperature was 37.2°C while the extreme minimum temperature was -45.0°C. The annual mean temperature is 2.7°C.

The average frost free period is 100 days. The last spring frost and first fall frost occur about May 28 and September 6. Frost has occurred as late as June 23 in spring and as early as August 2 in fall.

The wettest months are June and July, and the driest months are November and February. The mean total annual precipitation is 38.6 cm. The mean total rainfall is 28.0 cm and the mean total snowfall is 107.7 cm.

3. LANDSCAPE, SOILS AND LAND USE

3.1 Topography and Hydrology

The study area lies on the lower southern slopes of the Hand Hills and forms a part of the Hand Hills Upland (Stalker 1973). This is an erosion remnant left standing above the surrounding country when the region as a whole was lowered by erosion. The summit of the Hand Hills rises almost 200 m above the surrounding plains.

The terrain of the study area is gently undulating with the exception of the rolling landscape on the hill system in the southeast corner. The landscape is crossed by numerous well-defined drainage valleys. A few high hills rise up in the southeastern corner. Elevations range from about 800 m in the southwest corner to over 1 000 m in the extreme northern part.

Little Fish Lake is the only permanent body of water and covers approximately 855 ha. Upland areas are rapidly to moderately well drained with watertables below 2 m. Low-lying sloughs, wet meadows, and stream channels are imperfectly to very poorly drained, with seasonal watertables near the surface (Pedology Consultants 1983). Stream flows are intermittent, occurring principally in spring and immediately following rains in summer and fall. Most of the surface drainage is towards Little Fish Lake and the channel which flows westward from it into Willow Creek. Willow Creek flows into the Red Deer River. Some drainage in the southwestern portion is to the south into other coulees which also drain into the Red Deer River. Seepage areas occur locally along eroded badland slopes.

3.2 Bedrock Geology

Underlying bedrock is composed of Cretaceous sandstone deposits, with overlying formations of Tertiary gravel and sandstone (Irish 1963). Bedrock exposures are rare except along Willow Creek and associated coulees and on the summit of the high hill in the southeast corner.

The non-marine Edmonton Formation forms most of the outcrops and is the formation from which the badlands along Willow Creek have formed. The principal rocks are fine-grained sandstones, siltstones, and shales; some coal is also present.

Not previously noted in geological reports, Tertiary conglomerate outcrops are found on the hill in the southeast corner.

These rocks are quartzite and hard sandstone gravels, which are partly cemented with calcium carbonate to form the conglomerate and are probably related to other Tertiary deposits found on the summit of the Hand and Wintering Hills. There is a close lithological similarity between these rocks and the Oligocene gravels of the Cypress Hills Formation, although fossils indicate that the Hand Hills gravels are younger, probably of Pliocene age (Irish 1967). These gravels were deposited by rivers flowing directly eastward from the mountains, chiefly the ancestral Bow River.

3.3 Surficial Geology

Surficial deposits range from 6 to 16 m thick, except in badland areas along Willow Creek and on a hill top in the southeast corner where the surficial material is thin or non-existent.

The major surficial deposits are ground moraine and gravelly/sandy glaciofluvial materials. The ground moraine is generally gravelly in the high land in the extreme northeastern corner. This is rare in the surrounding region and appears to be confined to the summit of the Hand Hills. In the high land north of the glaciofluvial deposits and south of the gravelly moraine, the ground moraine has been modified by stream deposition. The glaciofluvial deposits were formed along a run-off channel leading from Little Fish Lake into Willow Creek. Sandy lacustrine materials are present along the shore of Little Fish Lake.

3.4 Soils

Most of the area is composed of loamy morainal materials. Along a former channel leading west from Little Fish Lake are sandy and gravelly glaciofluvial deposits. Gravelly phases of this deposit occur mostly south of the existing east-west drainage channel while the sandier deposits occur north of that channel. A few areas of clayey morainal materials are present adjacent to this alluvium and near the shore of Little Fish Lake (Pedology Consultants 1983). The loamy textured morainal materials occur primarily above 915 m, while the coarser glaciofluvial and finer clay textured morainal deposits are predominant below 915 m.

Most of the soils are loamy textured Orthic Dark Brown Chernozems on morainal materials. Along the outlet channel are gravelly and sandy Orthic Dark Brown Chernozem soils developed on glaciofluvial deposits. There are scattered areas of Rego Dark Brown Chernozem soils along the western slopes of the hill system in the south and along the coulees draining the western part of the area.

Clayey Dark Brown Solodized Solonetz, Gleyed Dark Brown Solonetz, or Dark Brown Solonetz soils on moraine and glaciofluvial materials occur near the outlet channel from Little Fish Lake and in a

small area of upland near the shore of Little Fish Lake.

Gleyed Dark Brown Chernozem and Rego Humic Gleysol soils occur in depressional areas where there is a seasonally high water table.

3.5 Land Use and Disturbance

All of the area is under grazing or haying disposition. The intensity of grazing varies from extremely heavy in areas adjacent to Little Fish Lake and its outlet channel to light in some pastures in the northern portion of the study area. Mowed areas occupy a smaller portion of the study area in Sections 2, 11, 25, 29, 34, 35, and 36. Mowing and grazing are discussed in greater detail in Chapter 7 and grazing and mowing intensities are shown on Map 1.

Section 25 is cultivated land. The north half of Section 25 was cultivated in the last five years.

Producing gas wells are located in Sections 2, 3, 21, 22, and 32. Most have been in operation since the mid-1970's. Gravel operations occur in Section 2. A graded road network connects the gas wells to the secondary road in the south. A major unimproved road runs north-south through the eastern portion of the study area. Elsewhere, dirt trails criss-cross the area, mostly following fencelines.

4. VEGETATION

Much of the Little Fish Lake study area lies within the Northern Fescue Grassland section of the Grassland natural region. A small western portion of the study area is more typical of the moister "northern" Mixed Grassland. On a global scale, very little of either grassland type remains in a natural state because this highly productive land has been converted to crops. The Little Fish Lake area is probably the largest area of Northern Fescue Grassland left in the world.

Northern Fescue Grassland is distinguished from the lusher Foothills Grassland by the absence of a variety of characteristic forbs. The Northern Fescue Grassland is not subject to the frequent chinooks and heavy spring snowfalls which affect the Foothills Grassland.

4.1 Fescue Grassland

The dominant species of fescue grasslands at Little Fish Lake is Festuca scabrella. The principal secondary graminoid species include:

Carex obtusata
Koeleria macrantha
Stipa curtiseta
Agropyron trachycaulum var. unilaterale
Danthonia californica
Helictotrichon hookeri
Poa interior

The last five species are most common and may become dominant in moist depressions and in areas adjacent to aspen clones. Sedges such as Carex praticola and Carex siccata are locally dominant in depressional areas in the northeastern corner of the study area. Very local patches dominated by Agrostis scabra, Bromus inermis or Bromus anomalus are also found in the northeastern corner. Other graminoids found in the fescue grasslands include Muhlenbergia richardsonis, Stipa viridula, Juncus confusus, and Carex xerantica.

Leading forbs include Geum triflorum, Galium boreale, Cerastium arvense, Artemisia ludoviciana, Campanula rotundifolia, and Anemone patens.

Other forbs include:

Lilium philadelphicum
Selaginella densa

Sisyrinchium montanum
Hedysarum alpinum
Zizia aptera
Achillea millefolium
Arabis hirsuta
Artemisia frigida
Dodecatheon conjugens
Castilleja lutescens
Potentilla arguta
Astragalus bisulcatus
Astragalus crassicarpus
Astragalus dasyglottis
Potentilla gracilis
Androsace septentrionalis
Gaillardia aristata
Potentilla bipinnatifida
Ranunculus pedatifidus
Ranunculus cardiophyllus
Solidago missouriensis
Anemone cylindrica
Astragalus flexuosus
Zigadenus elegans
Zigadenus venenosus
Ranunculus rhomboideus
Viola pedatifida (rare)
Thermopsis rhombifolia
Silene drummondii
Helianthus subrhomboideus
Hieracium umbellatum
Heuchera richardsonii
Vicia americana
Potentilla pensylvanica
Gentianella amarella
Lactuca pulchella
Oxytropis monticola
Oxytropis sericea
Solidago canadensis
Thalictrum venulosum
Habenaria viridis (rare)
Aster ericoides
Arnica fulgens
Penstemon procerus
Erigeron glabellus
Agoseris glauca

Many of the forbs achieve a high cover value along the minor drainage and depressions in the fescue grassland. The lushest and most diverse blooms occur in the grasslands in the northeast corner of the study area. Blooms of Lilium philadelphicum, Hedysarum alpinum, Castilleja lutescens, and Helianthus subrhomboideus predominate in that area (Hedysarum-Lilium-Castilleja type). Several species seem to be confined to that area, or at least achieve their greatest abundance there. In the southeastern portion, depressions may be carpeted with Penstemon procerus, Zigadenus venenosus, or Arnica fulgens blooms

(Arnica-Zigadenus type). Occasional blooms of Epilobium angustifolium can be found in sheltered depressions throughout the eastern portion of the study area. The fescue grasslands most depauperate in plant diversity and forb abundance are those in the northwestern portion of the study area.

4.2 Mixed Grassland

The dominant species of much of the mixed grassland is Stipa curtiseta. The principal secondary graminoid species include Agropyron dasystachyum and Koeleria macrantha. On the driest and most heavily grazed sites, Bouteloua gracilis and Carex stenophylla are the most abundant species. Carex filifolia also does well under conditions of moderate to heavy grazing. Sites subject to lighter grazing have higher proportions of Stipa comata, Stipa curtiseta, and Agropyron dasystachyum. Koeleria macrantha and Carex obtusata are prevalent in a variety of mixed grasslands. Stipa viridula is dominant in moister depressions, on coulee slopes, and on sandy soils. Agropyron smithii is dominant on solonetzic soils.

Leading forbs include Artemisia frigida, Phlox hoodii, and Selaginella densa.

Other forbs species of the mixed grassland include:

Artemisia ludoviciana
Erigeron caespitosus
Astragalus drummondii
Lomatium foeniculaceum
Lithospermum incisum
Allium textile
Androsace septentrionalis
Anemone patens
Potentilla concinna
Thermopsis rhombifolia
Astragalus missouriensis
Potentilla hippiana
Aster ericoides
Aster falcatus
Lappula occidentalis
Potentilla pensylvanica
Orthocarpus luteus
Linum lewisii
Liatris punctata
Lygodesmia juncea
Haplopappus spinulosus
Heterotheca villosa
Gaura coccinea
Campanula rotundifolia
Gaillardia aristata
Arabis divaricarpa

Solanum triflorum has only been found within the mixed grass communities on disturbed soil of badger and ground squirrel diggings.

Stipa viridula, Stipa curtiseta, Calamovilfa longifolia, and Elaeagnus commutata predominate on sandier sites. Other species found there include:

Draba nemorosa
Erysimum inconspicuum
Thermopsis rhombifolia
Equisetum laevigatum
Juniperus horizontalis
Oenothera nuttallii
Glycyrrhiza lepidota
Carex stenophylla
Carex filifolia
Poa interior
Heterotheca villosa
Artemisia frigida
Selaginella densa
Anemone patens
Helictotrichon hookeri
Carex douglasii

On solonetzic sites, Koeleria macrantha and Agropyron smithii appear to be dominant. Major species include Carex stenophylla, Selaginella densa, Bouteloua gracilis, Poa sandbergii, and Antennaria aprica. Other species found here include: Artemisia frigida, Grindelia squarrosa, Hordeum jubatum, and Distichlis stricta.

Many of the mixed grassland species are also found in the coulee grasslands. The coulee communities vary considerably over short distances. Species which are not prevalent on the uplands but which are more common in the coulees and along their rims include:

Muhlenbergia cuspidata
Poa cusickii
Paronychia sessiflora
Anemone multifida
Collomia linearis
Arabis holboellii
Lesquerella arenosa
Rosa arkansana
Hymenoxys richardsonii
Astragalus striatus
Astragalus tenellus
Oxytropis monticola
Oxytropis sericea
Psoralea esculenta
Sphaeralcea coccinea
Viola nuttallii
Cymopterus acaulis
Elymus canadensis
Opuntia polyacantha
Penstemon nitidus
Artemisia campestris

Comandra umbellata
Eriogonum flavum
Cirsium flodmannii
Cirsium undulatum
Senecio canus
Solidago spathulata

Chamaerhodos erecta and Erigeron compositus are prevalent on a handful of sandy, gravelly sites in the extreme northwest and southeast corners of the study area.

4.3 Aspen Woodland

Aspen occurs both as clones on the uplands in the northeast corner of the study area and in small stands within the coulee systems. The aspen clones on the uplands tend to be depauperate in understory plants, indicating relative youth or disturbance. The clones on the uplands have been increasing in size over the last decade. The dominant species is aspen, Populus tremuloides.

The predominant understory species in the upland clones is Bromus inermis. There is a relative scarcity of other species, the most prominent ones being Smilacina stellata, Rosa woodsii, and Symphoricarpos occidentalis.

Other species found in the upland clones include:

Artemisia ludoviciana
Campanula rotundifolia
Cerastium arvense
Festuca scabrella
Galium boreale
Fragaria virginiana
Epiiobium angustifolium
Carex siccata
Agoseris glauca
Heuchera richardsonii
Ribes oxyacanthoides
Solidago canadensis
Symphoricarpos albus
Thalictrum venulosum
Thermopsis rhombifolia
Vicia americana
Viola adunca

The major understory species in the coulee woodlands are Amelanchier alnifolia, Symphoricarpos spp., and Rosa woodsii. The understory composition is quite variable but there tends to be very little grass cover compared to the upland clones. Shrubs are prominent and include:

Salix bebbiana

Prunus virginiana
Ribes oxyacanthoides
Rubus idaeus
Ribes americanum
Juniperus communis
Cornus stolonifera

Forbs and grasses in coulee aspen stands include:

Disporum trachycarpum
Smilacina stellata
Moehringia lateriflora
Thalictrum venulosum
Fragaria virginiana
Galium boreale
Achillea millefolium
Actaea rubra
Anemone canadensis
Carex sprengellii
Pyrola asarifolia
Fragaria virginiana
Viola canadensis
Lathyrus ochroleucus
Agropyron trachycaulum
Lonicera dioica
Galium boreale
Geum triflorum
Heuchera richardsonii
Aster laevis
Aster ciliolatus
Poa interior
Solidago canadensis
Urtica dioica
Vicia americana
Zizia aptera

4.4 Shrub Communities

Shrub communities occur in a variety of locations. Four principal types are present: rose-buckbrush (Rosa acicularis), buffaloberry (Shepherdia canadensis), moist tall shrub, and silverberry (Elaeagnus commutata).

Salix petiolaris is dominant around only one slough in the mowed fescue grassland in the northeast corner of the study area.

Shepherdia argentea is found in isolated areas along the bottoms of coulees.

4.4.1 Rose-Buckbrush

The rose-buckbrush type is the most widespread, occurring in depressions in the grassland, around aspen groves, and on a variety of mesic coulee slopes. It is dominated by Rosa woodsii and Symphoricarpos occidentalis. The composition of associated species largely reflects the surrounding grassland. Many fescue grassland species thrive in the low shrub thickets. Graminoids are very sparse but include species such as Poa interior and Agropyron trachycaulum var. unilaterale. Forbs found in association with these low shrub thickets include:

Lilium philadelphicum
Smilacina stellata
Vicia americana
Zizia aptera
Achillea millefolium
Artemisia ludoviciana
Galium boreale

4.4.2 Buffaloberry

The buffaloberry community is an open low shrub type which occurs in the coulees and on the hill system in the southeast corner. This is dominated by Shepherdia canadensis. Major associates vary from site to site but include:

Amelanchier alnifolia
Cornus stolonifera
Juniperus horizontalis
Poa interior
Agropyron trachycaulum
Fragaria virginiana
Geum triflorum
Juniperus communis

Other species found here include a variety of grassland species, principally from fescue grasslands, including:

Agoseris glauca
Anemone multifida
Anemone patens
Artemisia frigida
Carex siccata
Comandra umbellata
Festuca scabrella
Helictotrichon hookeri
Gaillardia aristata
Galium boreale
Hedysarum alpinum
Koeleria macrantha

Linum lewisii
Oxytropis monticola
Phlox hoodii
Potentilla concinna
Rosa woodsii
Senecio canus
Zigadenus elegans
Zigadenus venenosus
Aster laevis
Smilacina stellata
Hedysarum alpinum
Solidago spathulata
Zizia aptera
Achillea millefolium
Antennaria aprica
Castilleja lutescens
Muhlenbergia cuspidata
Sisyrinchium montanum
Thermopsis rhombifolia
Solidago missouriensis
Arctostaphylos uva-ursi
Vicia americana

4.4.3 Moist Tall Shrub

Moist tall shrub communities are dominated by Salix bebbiana, Amelanchier alnifolia, Cornus stolonifera, and Prunus virginiana. The most diverse flora is found in those moist tall shrub communities located in the coulees. The upland type is Salix bebbiana, which grows in linear arrangements along depressions with nothing to distinguish the understory from surrounding communities.

Understory species in the moist tall shrub type include:

Cystopteris fragilis
Juniperus communis
Carex sprengellii
Disporum trachycarpum
Smilacina racemosa
Rubus idaeus
Smilacina stellata
Moehringia lateriflora
Actaea rubra
Anemone canadensis
Thalictrum venulosum
Ribes americanum
Ribes oxyacanthoides
Fragaria virginiana
Lathyrus ochroleucus
Urtica dioica
Vicia americana
Viola adunca

Viola canadensis
Pyrola asarifolia
Hackelia americana
Galium boreale
Lonicera dioica
Symphoricarpos occidentalis
Aster laevis
Erigeron glabellus

4.4.4 Silverberry

Elaeagnus commutata forms dense stands on sandy and gravelly glaciofluvial deposits in the western part of the study area. Associated species tend to reflect the surrounding mixed grassland. Principal species include Poa interior, Stipa viridula, and Symphoricarpos occidentalis.

4.5 Badlands

Badlands occur only along the western fringe of the study area in the steep-walled coulees draining into the Red Deer River. The badlands are depauperate compared to other badland areas in southern Alberta. Dominant plant species include: Artemisia cana, Atriplex nuttallii, Artemisia longifolia, and Gutierrezia sarothrae. Other species found in the mosaic of vegetation characteristic of the badlands include:

Eurotia lanata
Agropyron trachycaulum
Astragalus gilviflorus
Opuntia polyacantha
Plantago patagonica
Erigeron pumilus
Hymenoxys richardsonii
Iva axillaris

4.6 Alkaline Seepage Springs

Alkaline seepage springs occur in several locations in the coulees which dissect the western portion of the study area. Dominant plants include:

Distichlis stricta

Hordeum jubatum
Puccinellia nuttalliana
Glaux maritima
Iva axillaris
Aster brachyactis
Plantago eriopoda

Other species found in alkaline seepage springs include:

Triglochin maritima
Triglochin palustris
Deschampsia cespitosa
Poa arida
Spartina gracilis
Grindelia squarrosa
Scirpus pungens
Polygonum douglasii
Monolepis nuttalliana
Suaeda calceoliformis
Ranunculus cymbalaria
Dodecatheon pulchellum
Plantago elongata
Haplopappus lanceolatus

4.7 Wetlands

Wetlands are scarce in the study area, and the 1984 field season was an especially bad year to study them. Due to the extreme drought conditions which have characterized the past few years, many of the species which could be expected to occur there were not present.

Five types of wetlands can be identified: wet meadow depressions in fescue grassland, ephemeral sloughs, alkaline ponds, moist streamside vegetation, and the shore of Little Fish Lake. Alkaline ponds in the area do not appear to support any plant species.

Species of wet meadows and sloughs include:

Beckmannia syzigachne
Calamagrostis inexpansa
Hordeum jubatum
Carex atherodes
Carex arthrostachya
Juncus balticus
Polygonum amphibium
Rumex occidentalis
Rumex triangulivalvis
Potentilla norvegica
Collomia linearis
Stachys palustris
Mentha arvensis
Aster hesperius

Species found along creeks include:

Beckmannia syzigachne
Calamagrostis inexpansa
Glyceria elata
Spartina gracilis
Carex aurea
Carex lanuginosa
Carex pensylvanica
Carex praegracilis
Eleocharis palustris
Scirpus pungens
Juncus balticus
Juncus bufonius
Juncus longistylis
Salix exigua
Stellaria longipes
Ranunculus cymbalaria
Geum allepicum
Potentilla anserina
Glycyrrhiza lepidota
Oenothera biennis
Cicuta maculata
Primula incana
Mentha arvensis
Stachys palustris
Aster hesperius
Helianthus nuttallii

Species found along the shoreline of Little Fish Lake include:

Eleocharis palustris
Scirpus pungens
Juncus balticus
Chenopodium salinum
Potentilla anserina
Hordeum jubatum
Oenothera breviflora

5. WILDLIFE

5.1 Grassland

Ten species of birds, henceforth referred to as grassland birds, have been known to inhabit and nest in the grasslands of the study area; eight of these occur on a regular basis, while two are known from only one year, 1970 (unpublished field notes - C. Wallis, C. Wershler, W. Smith). A number of other bird species nest or feed in the grasslands but spend a significant portion of their time in other habitats.

Ungrazed or lightly grazed grassland is utilized by six species of grassland birds. The Sprague's Pipit and Baird's Sparrow are the most abundant; the former species is mostly restricted and the latter species entirely restricted to this habitat. The Sharp-tailed Grouse displays and feeds on the upland but usually nests on protected slopes of shallow coulees. It often forages in shrubbery on the upland and in coulees. The Upland Sandpiper appeared, in 1984, to be very local and uncommon. In previous years it had nested in a semi-colonial situation in a low-lying area of lush grassland and low shrubbery, before this area was opened up for grazing. The Savannah Sparrow frequents lush fescue grassland in low-lying areas, often in depressions and along temporary drainages.

The Western Meadowlark occupies a range of grassland types, from grazed to ungrazed, but seems to require a certain amount of ungrazed or lightly grazed grassland.

Three species of ducks -- the Northern Pintail, Blue-winged Teal, and Northern Shoveler -- are known to nest in the ungrazed grassland. Three species of raptors -- the Northern Harrier, Merlin, and Red-tailed Hawk -- have been observed hunting over this habitat.

Moderately to heavily grazed grassland is utilized by four grassland bird species; however, only two, the Horned Lark and Chestnut-collared Longspur, show a strong affinity for heavily grazed areas. The Horned Lark is restricted to grazed grassland. The Chestnut-collared Longspur also occurs in recently mowed grassland; its occurrence is erratic and it has not been recorded in the study area since 1970. The Vesper Sparrow is able to tolerate a certain amount of grazing but almost always nests on coulee slopes in lush grass and herbage. It shows an affinity for low shrubby areas in the sandy mixed grassland. The Western Meadowlark frequently forages in grazed grassland but requires taller grass clumps for nesting sites.

Two shorebirds, the Marbled Godwit and Willet, feed and possibly nest in grazed grassland. At least five birds of prey feed over grazed grassland: the Merlin, Northern Harrier, Swainson's Hawk, Red-tailed Hawk, and Ferruginous Hawk. The last three occur mostly in areas where

their major prey species, the Richardson's Ground Squirrel, is present.

Various species of birds inhabit mowed grassland during its recovery. The species of birds found vary with the different heights and densities of vegetation. The Long-billed Curlew and Chestnut-collared Longspur occurred, in 1970, in grassland which was cut very short the previous fall. The Sprague's Pipit and Savannah Sparrow appear when grass increases in height and density. Eventually, if an area is not mowed and the height and density of grasses is allowed to increase, then other species including the Upland Sandpiper, Baird's Sparrow, Western Meadowlark, and Sharp-tailed Grouse may become re-established.

Of the nine species of mammals which occur in the grasslands, only two appear to be partial to ungrazed or lightly grazed sites. The Thirteen-lined Ground Squirrel occurs locally on upland sites and in shallow shrubby coulees, and the Meadow Vole is found in the vicinity of low shrub patches, damp depressions, and possibly in very lush fescue. Other mammals observed in lush grassland include the Mule Deer, Pronghorn, Coyote, and White-tailed Jack Rabbit.

Grazed grassland is the major habitat of the Richardson's Ground Squirrel and two other mammal species, the American Badger and Long-tailed Weasel, which are largely dependent upon the Richardson's Ground Squirrel for food. Coyotes also forage regularly in ground squirrel colonies. The White-tailed Jack Rabbit is observed more often in grazed grassland than ungrazed, and the Mule Deer and Pronghorn also seem to occur more often in grazed grassland, especially in shrubby mixed grassland in areas of sandy soil.

The Coyote and the Thirteen-lined Ground Squirrel appear to be the only mammals which occur regularly in recently mowed grassland.

One reptile, the Common Garter Snake, has been observed in recently mowed fescue grassland.

5.2 Low Shrubbery

Low shrubbery is typically inhabited by three species of birds: the Clay-colored Sparrow in buckbrush and rose, the Common Yellowthroat at the edge of stream wetlands, and the Brewer's Blackbird in coulee bottoms. In addition, several ducks and the Northern Harrier often nest in thickets of buckbrush in other parts of Alberta, and probably also do so in the study area. The Eastern Kingbird commonly nests in low shrubs next to water.

The Meadow Vole is the only mammal frequently seen in low shrub communities.

5.3 Tall Shrubbery

Thickets of tall shrubbery are inhabited by at least 11 bird

species. The Black-billed Magpie, Rufous-sided Towhee, Brown Thrasher, Gray Catbird, and Cedar Waxwing occur in mixed shrubbery on mesic sites. The last three species are also found in damper willow stands. The Eastern Kingbird, Yellow Warbler, Red-winged Blackbird, and American Goldfinch frequent damp willow stands and adjacent habitats near water. Stands of silverberry in the mixed grassland are utilized by at least three species: the Sharp-tailed Grouse, Clay-colored Sparrow, and Brown Thrasher.

The Mule Deer is the most characteristic mammal frequenting the tall shrubbery in coulees. The White-tailed Deer and American Porcupine have also been observed in this habitat.

5.4 Woodland

A total of 17 bird species are typical inhabitants of aspen clones in the fescue grassland or aspen woods in coulees. Ten of these utilize both aspen clones and coulee woods: the Red-tailed Hawk, Swainson's Hawk, Great-horned Owl, Least Flycatcher, Black-billed Magpie, American Crow, Black-capped Chickadee, House Wren, Red-eyed Vireo, Warbling Vireo, Yellow Warbler, Brown-headed Cowbird, and Northern Oriole. Three species occur in coulee woods but rarely in aspen clones: the Mourning Dove, Tree Swallow, and American Robin. The Merlin is the only species found in aspen clones but not in coulee woods.

Since 1970, the number of bird species utilizing aspen clones in the grassland has increased. The Northern Oriole and Warbling Vireo, for example, were not recorded in aspen clones in 1970 but were in 1984. This increase in birds utilizing the aspen clones is possibly related to the increased growth of the trees and the outward spread of the clones.

White-tailed Deer are typically found in aspen clones but less often in coulee woods. On the other hand, Mule Deer occur most frequently in coulee woods but less often in aspen clones. The American Porcupine and Least Chipmunk also occur in wooded habitats, the latter being restricted to several coulees just west of the study area.

5.5 Wetlands

At least 15 species of ducks and shorebirds are regular summer residents around ponds and Little Fish Lake. Ducks include the Green-winged Teal, Mallard, Northern Pintail, Blue-winged Teal, Northern Shoveler, Gadwall, and American Wigeon. Shorebirds include the Spotted Sandpiper, Wilson's Phalarope, Upland Sandpiper, Willet, Marbled Godwit, American Avocet, Killdeer, and Piping Plover. The Upland Sandpiper, Piping Plover, and American Avocet are found only around the northwest end of Little Fish Lake. Upland Sandpipers nest well back from the lake on the sparsely vegetated backshore. American Avocets nest closer to

the lake in the same habitat and on islands which periodically form in the lake. Piping Plovers nest on pebbly portions of the shoreline.

More than 30 additional species of water birds have been recorded as summer visitors or migrants, mainly to Little Fish Lake. Other species including the Northern Harrier, American Crow, and several swallows feed on the shores or over the waterbodies.

Creeks and drainage channels, when they contain water, are occupied by a number of surface-feeding ducks. The Savannah Sparrow and Red-winged Blackbird inhabit damp sedges and grasses along the channels, and the Northern Harrier hunts along them.

In 1970, the drainage channel flowing into the northwest corner of Little Fish Lake was wet and contained lush grass and sedge beds. The area was frequented by two bird species, the Common Snipe and Short-eared Owl, which were not present in 1981 and 1984. Their disappearance may be related to a succession of dry years; however, a coincidental increase in cattle numbers in this area has severely damaged the habitat and may be responsible.

The Meadow Vole frequents the damp grassy edges of a variety of aquatic habitats. There is a single area of recent American Beaver activity in a creek valley in the northwest corner of the study area; the pond complex appears to be fairly recent.

The Chorus Frog is the most common amphibian in the area, breeding in a variety of aquatic habitats including ponds and pools in creek channels. The Leopard Frog has been recorded on one occasion at a pond in the northeast corner of the study area. It is likely that the Common Garter Snake also occurs on the vegetated shores of standing water, but it has yet to be recorded in this habitat in the study area.

5.6 Badlands

The badlands of Willow Creek and associated coulees on the northwest edge of the study area provide habitat for several bird species that occur elsewhere in the study area only as visitors or occasional summer residents. The Prairie Falcon, Ferruginous Hawk, Say's Phoebe, Rock Wren, Mountain Bluebird, and Cliff Swallow nest on eroding slopes or in cliffs in the study area and nearby.

The Mule Deer and American Porcupine are mammals that have been recorded in the badlands.

6. ANALYSIS

The study area represents one of the finest examples of northern fescue grassland left in the world. The wildlife and vegetation are an endangered ecosystem. Lush Northern Fescue Grasslands such as those found in this area are rare elsewhere in the world. The density and variety of forbs along the drainages is notable. The principal landscapes characteristic of Northern Fescue Grassland (Cottonwood Consultants 1983) represented at Little Fish Lake include ground moraine, sand plain, shallow marsh, protected slope, slightly alkali lake, wet meadow, weak solonetz uplands, and eroded bedrock. Other landscapes represented include hummocky moraine, eroded plain, alkali springs, turbid stream, and intermittent stream.

Landscapes which occur in the Northern Fescue Grassland (Cottonwood Consultants 1983) but which do not occur at Little Fish Lake include deep marsh wetlands, alkali lakes, open alkali wetlands, strongly solonetz uplands, meandering river terrace, fresh springs, sinuous river terrace, inactive terrace, abandoned channel, clear stream, permanent stream, dune fields and clay glacial lake basins. However, it should be noted that none of these features has distinctive plants or wildlife which are largely restricted to the Northern Fescue Grassland. All plants and wildlife associated with these features are more common in other natural regions.

The majority of the distinctive Northern Fescue Grassland features are associated with upland, non-wetland habitats on morainal landscapes. Evaluated on this basis, Little Fish Lake is an excellent representative of Northern Fescue Grassland vegetation and wildlife.

6.1 Vegetation

Moss and Campbell (1947) describe the general characteristics of both Foothills and Northern Fescue Grassland types. According to these descriptions, the Little Fish Lake area is principally Northern Fescue Grassland although some species such as *Castilleja lutescens* are mostly restricted to Foothills Grassland. All of the species Moss and Campbell consider common in the *Festuca scabrella* association of the Northern Fescue Grassland are found in the Little Fish Lake area. All but four of the rare or very rare species are also found here; at least two of these (*Spiranthes romanzoffiana* and *Spiraea alba*) are not really typical of fescue grassland. The others (*Solidago nemoralis* and *Penstemon gracilis*) may yet be found in the area as there are records from nearby sites.

Moss (1983) maps the distributions of all native plants known for Alberta. A review of this information shows only three species which have not been found at Little Fish Lake but which are common or restricted to the Northern Fescue Grassland. These include Solidago rigida, Poa canbyi and Arnica sororia. These species were probably not found because of the drought conditions. All three species occur in adjacent areas.

Coupland (1961) distinguishes Mixed Grassland from Northern Fescue on the basis of dominants and subdominants. He states that three important forbs (Cerastium arvense, Geum triflorum, and Galium boreale) do not occur in Mixed Grassland except in depressions. All these species are common in the fescue grasslands at Little Fish Lake.

The lightly grazed "northern" Mixed Grassland in the western part of the study area is analagous to Coupland's (1950) Stipa-Agropyron faciation. The dominants include Stipa curtiseta and Agropyron dasystachyum. Detailed descriptions of this type are not provided by Coupland but the dominant species and geographical setting are similar to what is described for "northern" Mixed Grassland.

Other parts of Alberta have fescue grassland but most exist only as small units. Larger areas of fescue grassland lie in areas of the southern Parkland at Rumsey (Fehr 1982) and Neutral Hills-Bodo (Bradley and Bradley 1977). These areas are more typical of the southern Aspen Parkland. The fescue grasslands of Rumsey and Neutral Hills-Bodo resemble those at Little Fish Lake but there are important differences. Several fescue grassland species, which are known at Little Fish Lake, have not been found at either Rumsey or Neutral Hills-Bodo. These include rare species (for the Northern Fescue Grassland) such as Juncus confusus, Viola pedatifida, and Castilleja lutescens, as well as more widespread species such as Habenaria viridis, Astragalus dasyglottis, Astragalus tenellus, and Dodecatheon conjugens. There are qualitative differences as well. Even though the following species have been found at Rumsey or Neutral Hills-Bodo, they are much more abundant at Little Fish Lake:

Hedysarum alpinum
Muhlenbergia richardsonis
Carex pensylvanica
Anemone cylindrica
Lilium philadelphicum
Arnica fulgens
Erigeron glabellus

It is the diverse and lush forb communities which set Little Fish Lake apart from any other site in the Northern Fescue Grassland or southern Aspen Parkland.

6.2 Wildlife

No wildlife species are restricted to the Northern Fescue Grassland Natural Region, but species such as the Thirteen-lined Ground

Squirrel, Sharp-tailed Grouse, Sprague's Pipit, Upland Sandpiper, and Baird's Sparrow, present in moderate or high numbers in the lush grassland of the study area, are very characteristic of the region. These species are generally uncommon in other parts of the Grassland natural region. The Sprague's Pipit, Upland Sandpiper, and Baird's Sparrow are most abundant in native, ungrazed Northern Fescue Grassland.

The Little Fish Lake area has higher densities of Upland Sandpipers, Sprague's Pipits, and Baird's Sparrows than any other site in the southern Aspen Parkland, including Rumsey and Neutral Hills-Bodo. There may be small areas of Northern Fescue Grassland with high densities of these species, however, we know of no other extensive areas with such high populations as those at Little Fish Lake.

The species composition of wildlife at Little Fish Lake is very representative of the Northern Fescue Grassland. All the bird, mammal, reptile, and amphibian species typical of Northern Fescue Grassland (C. Wallis, C. Wershler, unpublished data) occur in the grassland, low and tall shrubbery, and woodland habitats. Most of these species are present as viable populations. Some species such as the Northern Pocket Gopher and American Badger are more common in other grassland sites. The Long-tailed Weasel is rare at Little Fish Lake. It has declined over much of its range and is now rare throughout the grassland region.

Ponds and marshes are the most poorly represented wildlife habitats. Tall emergent marshes of bulrush and cattail are absent and, as a result, a number of species such as the Yellow-headed Blackbird and Ruddy Duck are also absent. However, extensive marshes of this type are more typical of the Parkland and are very local in the Northern Fescue Grassland.

Seasonal ponds and sedge marshes are rare in the study area. Although most representative wildlife of these wetland types occur, their numbers are generally low.

As a staging area for shorebird and waterfowl migration, Little Fish Lake is representative of the Northern Fescue Grassland. Only the more northeasterly parts of the region, in areas of solonetzic soil and more alkaline ponds and lakes, are known to be significantly more important as staging areas for these birds (T. Sadler, Ducks Unlimited, personal communication). For example, Kirkpatrick Lake is a provincially significant stopover site for four species of geese.

A small percentage of the wildlife is more typical of the Mixed Grassland. These species occur mainly in heavily grazed grasslands and tall shrubbery along coulees.

6.3 Significant Features

Much of the area could be considered significant because of the scarcity of fescue grassland in other parts of the world. The vegetation and wildlife features outlined on Map 2 and in the following sections are those which are the best examples found in the study area.

The prime significant features are found or, until recent changes in grazing patterns disturbed them, were found in Sections 2, E10, 11, 12, S13, S14, 25, E35, NW36, S36, Township 28, Range 17, West

of the Fourth Meridian. It is felt that the condition of some of the degraded areas is still recoverable and it may be possible to restore these lands to their former significance. Secondary, but still important features, are found in Sections 15, 22, E32, NW33, S33, 34, W35 of the same township; Sections 15, 29, 34, and W35 are particularly noteworthy.

There are other significant features which, while not representative of fescue grassland, are either rare in the region or are productive wildlife habitats. These include seepage springs along the coulees which drain into Willow Creek; lightly grazed "northern" mixed grassland just west of the study area boundary; beaver pond habitat along Willow Creek; Richardson's Ground Squirrel habitat in the vicinity of the outlet channel from Little Fish Lake; and diverse coulee shrubbery and woodland along the coulees which run into Willow Creek.

The conglomerate outcrops found on the hill in the southeast corner represent one of a handful of such occurrences in Alberta. No provincially significant plants and animals are known from this site, however, there are several species found here which are uncommon within the study area.

6.3.1 Vegetation

The most productive fescue grasslands, in terms of plant species diversity, are those in the extreme northeast corner of the study area. Included are lush forb areas representative of a Hedysarum-Lilium-Castilleja type. The next most productive are those which occur on the hill in the southern portion. Included here are those grasslands adjacent to Little Fish Lake which, until five years ago, were in excellent condition and had lush forb areas representative of an Arnica-Zigadenus type. All these areas contain rare or uncommon plant and animal species.

The fescue grasslands west of the above areas are less diverse and contain fewer uncommon species. Nonetheless, they are representative of the Northern Fescue Grassland, and sites of such excellent condition are difficult to find.

Several of the native plants of the fescue grassland are uncommon in other parts of the grasslands east of the foothills region. These include Lilium philadelphicum, Dodecatheon conjugens, and Castilleja lutescens. Other species which are rare in the province include Viola pedatifida, a species of ungrazed fescue grasslands; Juncus confusus, a plant found in depressions in the northeastern corner; and Oenothera breviflora, a species found along the sandy alkaline shore of Little Fish Lake (Packer and Bradley 1984).

6.3.2 Wildlife

Four species in the area are considered "threatened" according to the Committee on the Status of Endangered Wildlife in Canada. These

are the Prairie Long-tailed Weasel, Ferruginous Hawk, Piping Plover, and American White Pelican. Pelicans and Ferruginous Hawks do not nest within the study area, although there are several abandoned eyries of the latter species along Willow Creek. The anatum subspecies of the Peregrine Falcon migrates through the area and is considered "endangered". Three nesting species -- the Baird's Sparrow, Sharp-tailed Grouse, and Upland Sandpiper -- are becoming increasingly rare.

The northwest shore of Little Fish Lake is a regular resting site for flocks of hundreds to thousands of Snow Geese during the fall migration.

The aspen clones in fescue grassland in the northeast corner of the study area have in years past contained one of the highest known nesting densities of Merlins in natural habitat.

Map 1. Range Condition, Improvements

Condition Classes

Mowed Areas:

Excellent - least frequently mowed

Good - most frequently mowed

Grazed Areas:

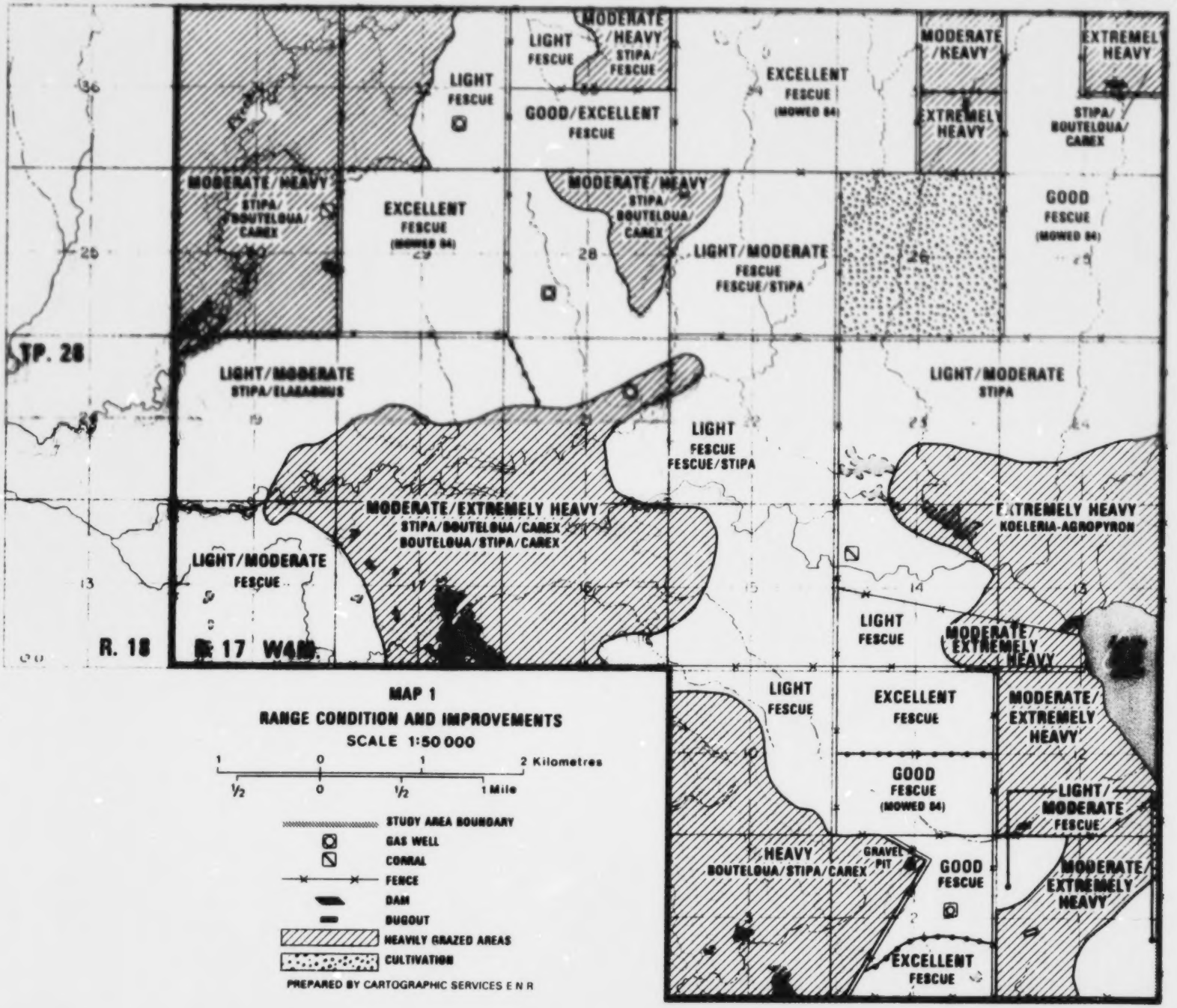
Light - good range condition, usually with abundant fescue grassland species, fescue clumps (except on sandy and gravelly soils)

Moderate - fair range condition, patchwork of mixed grassland and fescue grassland species

Heavy - poor range condition, dominated by mixed grassland species, few fescue grassland species

Extremely Heavy - very poor range condition, exposed soil, dominated by grazing increaser species of mixed grassland

Where no vegetation type designation follows a grazing condition, it indicates the area is in a state of transition due to recent land use changes. Until five years ago, these areas had mowed fescue grasslands in excellent conditon.


LIGHT FESCUE
MODERATE/HEAVY STIPA/FESCUE
GOOD/EXCELLENT FESCUE
EXCELLENT FESCUE (MOWED 84)
MODERATE/HEAVY
EXTREMELY HEAVY
EXTREMELY HEAVY
STIPA/BOUTELOUA/CAREX
MODERATE/HEAVY STIPA/BOUTELOUA/CAREX
EXCELLENT FESCUE (MOWED 84)
MODERATE/HEAVY STIPA/BOUTELOUA/CAREX
LIGHT/MODERATE FESCUE FESCUE/STIPA
GOOD FESCUE (MOWED 84)
TP. 28
LIGHT/MODERATE STIPA/ELAEAGNUS
LIGHT/MODERATE STIPA
LIGHT FESCUE FESCUE/STIPA
MODERATE/EXTREMELY HEAVY STIPA/BOUTELOUA/CAREX BOUTELOUA/STIPA/CAREX
EXTREMELY HEAVY KOELERIA-AGROPYRON
LIGHT/MODERATE FESCUE
LIGHT FESCUE
MODERATE/EXTREMELY HEAVY
R. 18
R. 17 W4M
LIGHT FESCUE
EXCELLENT FESCUE
MODERATE/EXTREMELY HEAVY
GOOD FESCUE (MOWED 84)
LIGHT/MODERATE FESCUE
HEAVY BOUTELOUA/STIPA/CAREX
GRAVEL PIT
GOOD FESCUE
MODERATE/EXTREMELY HEAVY
EXCELLENT FESCUE
MAP 1
RANGE CONDITION AND IMPROVEMENTS
SCALE 1:50 000
1 0 1 2 Kilometres
½ 0 ½ 1 Mile
STUDY AREA BOUNDARY
GAS WELL
CORRAL
FENCE
DAM
DUGOUT
HEAVILY GRAZED AREAS
CULTIVATION
PREPARED BY CARTOGRAPHIC SERVICES E N R

Map 2. Special Features, Plot Locations

Plot Locations refer to those in field notes

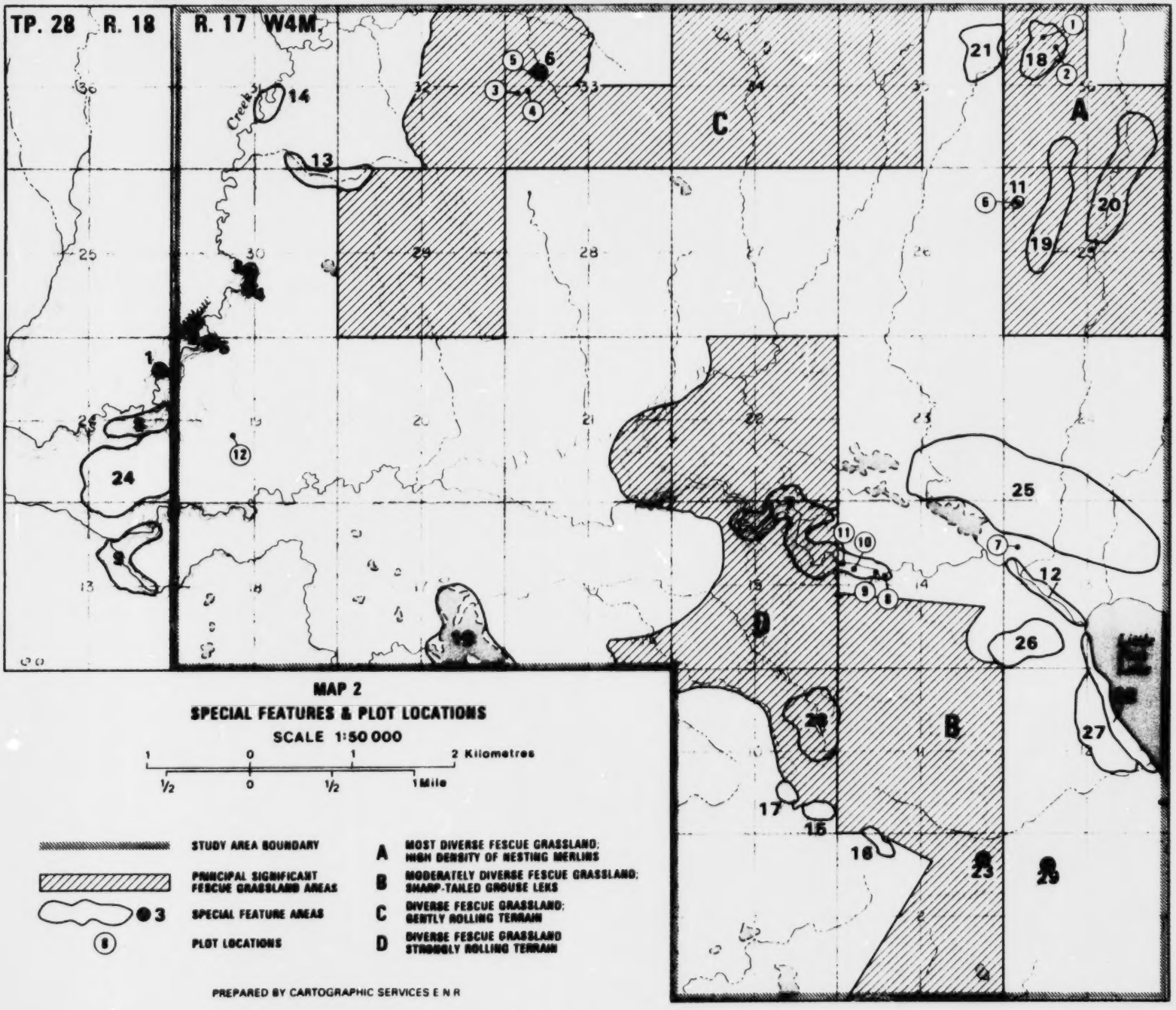
Principal Significant Fescue Grassland Areas

*A - Most diverse fescue grassland; high density of nesting Merlins
*B - Moderately diverse fescue grassland; Sharp-tailed Grouse leks
C - Diverse fescue grassland; gently rolling terrain
D - Diverse fescue grassland; strongly rolling terrain

Special Features

1 to 4 - abandoned Ferruginous Hawk eyries
5 - seepage spring
6 - diverse seepage spring
7 to 9 - diverse coulee shrubbery and woodland with ephemeral streams; productive wildlife habitat
10 - alkaline pond
*11 - ungrazed slough
*12 - wetland; formerly productive for wildlife
13 - ungrazed seepage spring
14 - beaver pond; productive wildlife habitat
*15 to 17 - conglomerate outcrops
*18 to 20 - diverse, lush forb communities (Hedysarum-Lilium-Castilleja type); Juncus confusus, Viola pedatifida,
*21 - formerly best Lilium philadelphicum area
*22 - Piping Plover, Upland Sandpiper nesting area; Snow Geese migration site; Oenothera breviflora
*23 - Viola pedatifida
24 - lightly grazed "northern" mixed grassland
25 - densest Richardson's Ground Squirrel populations
*26 - formerly highest nesting density of Upland Sandpipers
*27 - formerly lush forb meadows (Arnica-Zigadenus) type
*28 - diverse buffaloberry, moist shrub, seepage spring communities
*29 - former Sharp-tailed Grouse lek

* - denotes prime sites


TP. 28 R. 18
R. 17 W4M.
Creek
A
B
C
D
MAP 2
SPECIAL FEATURES & PLOT LOCATIONS
SCALE 1:50 000
2 Kilometres
1 Mile
STUDY AREA BOUNDARY
PRINCIPAL SIGNIFICANT FESCUE GRASSLAND AREAS
SPECIAL FEATURE AREAS
PLOT LOCATIONS
A MOST DIVERSE FESCUE GRASSLAND; HIGH DENSITY OF NESTING MERLINS
B MODERATELY DIVERSE FESCUE GRASSLAND; SHARP-TAILED GROUSE LEKS
C DIVERSE FESCUE GRASSLAND; GENTLY ROLLING TERRAIN
D DIVERSE FESCUE GRASSLAND STRONGLY ROLLING TERRAIN
PREPARED BY CARTOGRAPHIC SERVICES E N R

7. MANAGEMENT

Much of the native grassland of Alberta has been heavily grazed over the last 50 years. As a result, about half of the range produces less forage than it was capable of producing in pre-settlement times. In general, native range on large ranches is in the best condition while that of small holdings is in the poorest condition (Smoliak et al. 1979). Recovery of these depleted ranges can be very slow, if it occurs at all.

Moss and Campbell (1947) assert that the fescue grassland was largely ungrazed or lightly grazed by bison. They support their contention by pointing to the wide distribution of rough fescue and the fact that it is easily eliminated by grazing. Also, historical records point to the conclusion that large numbers of plains bison did not range northward as far as the fescue grassland and that wood bison remained farther north. While this may not be true in all cases, large areas of fescue grassland were probably grazed only periodically or not at all.

The role of fire in this ecosystem is not understood. There has been no compilation of the historical information on this subject for the Northern Fescue Grassland in Alberta.

Mowing seems to be the least deleterious land use in terms of the typical ungrazed fescue grassland species. Effects on various species generally seem to be short-lived and the full species complement returns within a year or two after mowing. Rough fescue retains its cover even after repeated mowing. Grazing virtually eliminates rough fescue.

Grazing has steadily increased in the area since the change of lessees and subsequent change in grassland management in the early 1980's. The effect has been very noticeable in fescue grasslands in the northeast corner, and near the shore of Little Fish Lake, and also on wetland and shoreline communities associated with the outlet channel, beach, and backshore of Little Fish Lake.

7.1 Effects of Grazing and Mowing on Vegetation

Grazing has a marked effect on the vegetation of the study area. Many of the increaser species are also characteristic of drier mixed grassland vegetation and are generally common and widespread species. Major increasers with grazing, in fescue grasslands are: *Artemisia frigida*, *Koeleria macrantha*, *Bouteloua gracilis*, *Carex obtusata*, *Antennaria nitida*, and *Selaginella densa*. These species can tolerate heavy grazing pressure. Other plants which increase under light to

moderate grazing include:

Anemone patens
Agropyron trachycaulum var. *unilaterale*
Stipa comata
Phlox hoodii
Orthocarpus luteus
Stipa curtiseta
Sphaeralcea coccinea
Geum triflorum
Poa interior
Solidago missouriensis

Plants which decrease with grazing are generally species which are uncommon or restricted to fescue grasslands. Major decreasers include: *Festuca scabrella* and *Helictotrichon hookeri*. Other decreasers include:

Cerastium arvense
Lilium philadelphicum
Hedysarum alpinum
Artemisia ludoviciana
Gentianella amarella
Castilleja lutescens
Muhlenbergia richardsonis
Heuchera richardsonii
Silene drummondii
Agoseris glauca
Galium boreale

Many of these species are almost completely eliminated by heavy grazing and quite a few do not tolerate even light grazing.

It appears that mowing, as practised up to 1980, appears to have had minimal effect on the characteristic fescue grassland species. Abundance may change temporarily and certain forbs may increase with the reduction of grass competition, however, stability returns quickly to this community. At Little Fish Lake, rough fescue is clearly dominant in all but the grazed sites. It has been noted in other areas, however, that repeated and severe mowing can eliminate *Festuca scabrella* and *Stipa curtiseta* (Owens 1971).

7.2 Effects of Grazing and Mowing on Wildlife

Miller and Graul (1980), Kirsch, Klett, and Miller (1973), and Kirsch, Deubbert, and Kruse (1978) note significant declines in upland nesting birds as a result of grazing and haying activities. In two areas in the United States, these were considered to be primary or secondary factors resulting in the decline of Sharp-tailed Grouse. Braun (1978) reports that at least 55 waterfowl studies show that grazing is detrimental to waterfowl production.

Changes in grassland habitats caused by grazing affect different species of wildlife in the Little Fish Lake area in different ways. Certain species of animals, like the Baird's Sparrow, Sprague's Pipit, and Thirteen-lined Ground Squirrel, require ungrazed or lightly grazed grasslands and are intolerant of heavy grazing. Our research suggests that Sharp-tailed Grouse and Upland Sandpipers have significantly declined in the area due to increased grazing intensity in the last five years.

A major change in grazing also occurred along the shoreline of Little Fish Lake. The destruction of vegetation, churning up of the shoreline, and trampling of nests have made it unsuitable for the threatened Piping Plover and several species of migrating and nesting birds. Usually it is the uncommon or threatened species that are most affected by an increase in grazing or mowing intensity.

Other species, like the Horned Lark and Richardson's Ground Squirrel, do best in heavily grazed grasslands and are unable to thrive in ungrazed or lightly grazed areas. However, most of the species that thrive in heavily grazed sites are not characteristic of fescue grasslands. They are more typical of the drier mixed grasslands.

Evidence suggests that annual cover removal on grasslands may be detrimental to the production of most upland birds, however, periodic treatments to remove cover on designated areas by fire, grazing, or mowing may be desirable for the long-term maintenance of upland nesting habitats in their best ecological condition (Kirsch, Duebbert, and Kruse 1978).

Comparisons between grassland management for livestock and for wildlife can be made. When grasslands are managed for livestock, grazing is usually the dominant practice. At most, only small areas remain ungrazed. In comparison, to maintain optimal habitats for most upland nesting birds, it is desirable to maintain a large percentage of the total habitat in an undisturbed condition. Small areas would be grazed moderately or heavily while large areas would be grazed lightly or not at all.

In the days when nomadic bison foraged in the Little Fish Lake area, a variety of habitats may have existed, ranging from trampled, heavily grazed areas to lush, undisturbed areas. Owens (1973) states that grassland birds apparently evolved to exploit different niches within this variable environment. Habitats alternated between lush and sparse in response to shifting climatic conditions, bison grazing, and fires. This scenario has implications for the type of management required today in order to maintain the natural variety of wildlife.

7.3 Current Range Condition

Map 1 indicates the general condition of the range in the Little Fish Lake area. This varies from excellent condition fescue with no signs of recent grazing or mowing to extremely heavily grazed sites where there is little left of the native fescue grassland. The prime remaining fescue grassland sites are in the following locations within Township 28, Range 17, West of the Fourth Meridian:

excellent condition - Sections SE2, N11, 29, S33, 34, W35
good condition - NE2, S11, 25, S and NE36.

Much of the remaining range, other than the heavily grazed areas mentioned below, is grazed lightly or moderately but does not have the full complement of fescue grassland plant and animal species. It tends to be somewhat intermediate in character between mixed grassland and fescue grassland types.

Changes in land use over the last five years have had profound effects on the range condition. Some areas that were excellent condition fescue grassland are now extremely heavily grazed. These lands lie in Sections 1, 12, S13, SE14, and E35. The trend on these lands is away from fescue species and towards mixed grassland species; however, the situation has not yet stablilized. Some sites could still recover, given sufficient rest from grazing pressure. These sites were formerly mowed pastures. Heavy grazing has continued and intensified in the solonetzic soil area northwest of Little Fish Lake along the outlet channel. This has resulted in destruction of shoreline habitat as well as valuable wetland vegetation along the outlet channel and associated ponds.

7.4 Management Approaches

Management of native grasslands should be undertaken to enhance or maintain both species richness and key individual species. In the Little Fish Lake area, the species which are characteristic of Northern Fescue Grassland should have top priority because of the scarcity of this habitat type in the world. Other management priorities should include the preservation of threatened or rare species. In order to accomplish this, the vegetation must be managed in a manner which will produce the desired results for plants and animals.

A spectrum of grazing regimes, including heavy, moderate, light, and no grazing, should be part of a management plan. Eventually, as its role is better understood, fire may also prove useful. Care must be taken to protect undisturbed examples of the most productive habitats: lake and pond shorelines, beaver ponds, lush creek bottoms and drainages, tall shrubbery, woodlands, and lush grasslands. Areas of heavily grazed grassland supporting major ground squirrel colonies should also be maintained.

The wildlife populations and plant species diversity in representative areas should be monitored in order to determine the appropriate grazing and mowing systems. To ensure the long-term survival of rare species, the habitats must be manipulated or protected to reduce the limiting factors.

7.4.1 Grazing and Mowing Philosophies

In a draft paper prepared by Bradley (1984) for the Public Lands

Division, several alternatives are presented for grazing strategies in grassland reserves. These include approximating the natural grazing regime; no grazing for benchmark purposes; grazing only for specific species management objectives; grazing to maximize species diversity; and grazing while avoiding specific negative effects.

It would be impossible to mimic the natural grazing regime because of the limited land area and the fact that cattle do not graze like bison. Cattle, unlike bison, often graze in swales or shallow depressions and graze more selectively. Bison appear more catholic in their plant preferences and may be able to more fully exploit the native range.

Leaving an area ungrazed and unmowed is a viable option for smaller areas of about a section. These could serve as a benchmark for comparisons with other areas which are grazed or mowed. These areas may be burned, grazed or mowed on a periodic basis if this is considered ecologically desirable. This could occur if research shows that a lack of grazing, mowing, or burning is resulting in a loss of significant plants or animals.

Grazing to ensure the survival or maintenance of certain species should play a smaller role in this area than in mixed grassland where grazing appears to have a more significant ecological role. Grazing could be applied to maintaining Richardson's Ground Squirrel populations and their associated ecosystems.

Grazing to avoid specific negative effects can be useful, but should not be the management philosophy for this site. This approach achieves many traditional range management objectives; however, it would not fully achieve the objectives of ecologically sensitive fescue grassland management. Enough is known about the ecology of the area that a more active management approach can be taken.

Grazing and mowing to maximize species diversity should be one of several objectives. Where maximizing diversity and maintaining significant fescue grassland values conflict, then management for fescue grassland species should take precedence.

Bradley (1984) states that mowing is not a substitute for a natural ecological process. However, since cattle do not exactly mimic the natural regime, mowing must be considered for this site. Grazing has numerous adverse effects on fescue grassland while periodic mowing has minimal adverse effects on the fescue grassland species most in need of protection. In fact, mowing appears to benefit many of the characteristic fescue grassland forbs. Mowing should be carried out only once every three or four years as done through the 1970's.

Any management system must reduce adverse effects on populations of uncommon or significant species, for example, Sprague's Pipit, Baird's Sparrow, Sharp-tailed Grouse, and Upland Sandpiper. It must avoid degradation of the productive wetlands and must prevent an undesirable shift in the fescue community from one of characteristic and uncommon fescue grassland species to one of common mixed grassland species. Specific management guidelines to protect very rare species (Viola pedatifida, Juncus confusus, Oenothera breviflora, Piping Plover) must also be implemented.

Most of the preceding philosophies should be applied to the proposed natural area/ecological reserve. To perpetuate fescue grassland species mowing, light grazing, and no grazing are the preferred options. These techniques should be applied, at a minimum, to

the lush northeast corner and to the hill system in the southeast. More intensive grazing could continue in the solonetzic soil zone along the outlet channel from Little Fish Lake. However, portions of the wetlands along the channel should be fenced out completely from cattle grazing and allowed to recover to their former productive state. A major portion of the shoreline of Little Fish Lake should be removed entirely from cattle grazing to allow the area to recover for Piping Plover nesting and for other species of nesting and migrating shorebirds and waterfowl.

7.4.2 Grazing Systems

Buttery and Shields (1975) summarize the effects of different grazing systems on native birds. They indicate that yearlong, continuous summer, and common use grazing are all detrimental to bird habitats, either because the vegetation is not allowed to rest or, in the case of common use grazing, because the number of feeding strata and niches are reduced when several types of grazers forage. Deferred grazing, deferred rotation, alternate use, and rest rotation grazing offer better opportunities for bird habitats to be maintained. Alternate use is probably not viable for the Little Fish Lake area because it involves using different kinds of livestock in different years. Cattle are the only livestock likely to graze the area. Reactions to rotation systems are mixed since the grazed pasture is usually used heavily even though the ungrazed pasture is rested. Nevertheless, rotation still offers benefits over the most detrimental systems.

With respect to the type of grazing systems that should be implemented, a combination of deferred and rested types is recommended for most of the lightly grazed land. Some areas should remain ungrazed for one or several years to allow vegetation recovery. Other sites should allow cattle use only after seed production and nesting of various birds has been completed. Burning should be investigated as an alternate or complementary management technique.

7.5 Conclusion

Most of the study area leases where sold at the auction of the Verdant Valley Ranch in December of 1984, and there are several new managers. In order to avoid the kinds ecological degradation created in other areas by breaking up leases into smaller holdings, it is suggested that trained ecologists work with these new lessees to establish a management plan which embodies the philosophies outlined above. Delays in implementing such a plan could mean further degradation and irretrievable loss of specific resources of the vanishing fescue grassland.

Little Fish Lake offers a unique opportunity to study the

effects of various grazing systems on native fescue grassland plants and animals. The research began fifteen years ago, so there is already a baseline of data on which to build. There is the ability to document the historic records and grazing regime, document the sensitivity of various habitats to grazing; and determine the most appropriate systems of grazing.

APPENDIX 1: ANNOTATED LIST OF FLORA

The following is a list of all native vascular plants reported in the Little Fish Lake study area. Taxonomy follows Moss (1983).

SELAGINELLACEAE

Selaginella densa Rydb. Widespread in grasslands, most abundant in heavily grazed areas.

EQUISETACEAE

Equisetum arvense L. Rare in springy areas.
Equisetum laevigatum A. Br. Occasional in moist sandy soil.

POLYPODIACEAE

Cystopteris fragilis (L.) Bernh. Occasional in tall shrub thickets in coulees.

CUPRESSACEAE

Juniperus communis L. Occasional on sandy coulee slopes.
Juniperus horizontalis Moench Fairly common on coulee slopes.

JUNCAGINACEAE

Triglochin maritima L. Occasional in saline spring/seepage areas.
Triglochin palustris L. Scarce in saline spring/seepage areas.

GRAMINEAE

Agropyron dasystachyum (Hook.) Scribn. Dominant species on ungrazed grassland on sandy glaciofluvial materials near Willow Creek. Occasional elsewhere.
Agropyron smithii Rydb. Occasional on heavy clay soils near saline spring/seepage areas and on solonetzic soils near Little Fish Lake.
Agropyron trachycaulum (Linke) Malte var. trachycaulum Fairly common on badland slopes on heavier clay soils.
Agropyron trachycaulum (Linke) Malte var. unilaterale (Cassidy) Malte Found throughout the fescue grasslands; locally common in depressions and around aspen clones. Appears to increase with moderate grazing.
Agrostis scabra Willd. Occasional throughout fescue grasslands and moist depressions.
Alopecurus aequalis Sobol Reported by Natural Areas Program.

Beckmannia syzigachne (Steud.) Fern. Occasional along creeks and in wet meadow/slough sites.
Bouteloua gracilis (HBK) Lag. Dominant species on heavily grazed and exposed sites.
Bromus anomalus Rupr. ex Fourn. Occasional in fescue grasslands in northeast corner of study area.
Bromus inermis Leyss. Occasional in fescue grasslands in northeast corner of study area. Native and non-native varieties are present.
Calamagrostis inexpansa A. Gray Occasional along creeks and in wet meadow/slough sites.
Calamovilfa longifolia (Hook.) Scribn. Principal species in some areas of sandy glaciofluvial materials and on conglomerate slopes.
Danthonia californica Boland Widespread in fescue grasslands; locally dominant in moist depressions, particularly in northeast corner of study area.
Deschampsia cespitosa (L.) Beauv. Scarce in seepage springs.
Distichlis stricta (Torr.) Rydb. Dominant in parts of alkaline spring/seepage areas.
Elymus canadensis L. Scarce on disturbed sandy soil in coulees and along slopes.
Festuca scabrella Torr. Dominant species of fescue grasslands; can be eliminated by heavy grazing.
Glyceria elata (Nash) A.S. Hitchc. Scarce, found only along a tributary to Willow Creek (south of corrals).
Helictotrichon hookeri (Scribn.) Henr. Secondary dominant in fescue grasslands; can be eliminated by grazing and mowing.
Hordeum jubatum L. Dominant in parts of alkaline spring/seepage areas and in wet meadows.
Koeleria macrantha (Ledeb.) J.A. Schultes f. Dominant in heavily grazed grasslands; fairly common in other grasslands.
Muhlenbergia cuspidata (Torr.) Rydb. Leading species on eroding till slopes in coulees.
Muhlenbergia richardsonis (Trin.) Rydb. Occasional in fescue grasslands.
Poa arida Vasey Found only in seepage along north boundary of study area.
Poa cusickii Vasey Fairly common on coulee slopes.
Poa interior Rydb. Locally dominant in fescue grasslands.
Poa juncifolia Scribn. Reported by Natural Areas Program.
Poa sandbergii Vasey Fairly common in heavily grazed grasslands on solonetzic soils.
Puccinellia nuttalliana (Schult.) A.S. Hitchc. Dominant in parts of alkaline spring/seepage areas and in wet meadows.
Spartina gracilis Trin. Occasional in alkaline spring/seepage areas and along creeks.
Stipa comata Trin. & Rupr. Dominant in lower elevation grasslands.
Stipa curtiseta (A.S. Hitchc.) Barkworth Dominant in higher elevation grasslands.
Stipa viridula Trin. Locally dominant on coulee slopes and on sandy glaciofluvial materials.

CYPERACEAE

Carex atherodes Spreng. Dominant in wet meadow/slough sites.

Carex arthrostachya Olney Frequent in wet meadow/slough sites.
Carex aurea Nutt. Scarce along creeks.
Carex douglasii Boott Scarce on sandy glaciofluvial materials.
Carex filifolia Nutt. Locally dominant on heavily grazed sites, especially at lower elevations.
Carex lanuginosa Michx. Fairly common along creeks.
Carex obtusata Lilj. Leading species in all grasslands.
Carex pensylvanica Lam. var. digyna Boeckl Found only along Willow Creek valley.
Carex praegracilis W. Boott Occasional along creek floodplains.
Carex praticola Rydb. Locally dominant in fescue grassland depressions.
Carex siccata Dewey Occasional on slopes associated with conglomerate outcrops and in depressions in fescue grassland.
Carex sprengellii Dewey Occasional in shrub thickets.
Carex stenophylla Wahl. Fairly common in coulee and grazed grassland; indicator of heavily grazed sites.
Carex xerantica Bailey Occasional in moist grassland.
Eleocharis palustris (L.) R. & S. Fairly common along creeks and the shoreline of Little Fish Lake.
Eleocharis quinquefolia (F.X. Hartm.) O. Schwarz Reported by Natural Areas Program.
Scirpus pungens Vahl Locally abundant along creeks, saline seeps, and the shore of Little Fish Lake.

JUNCACEAE

Juncus balticus Willd. Occasional in wet meadows, along creeks, and the shore of Little Fish Lake.
Juncus bufonius L. Occasional along creeks.
Juncus confusus Colville Scarce in moist depressions in fescue grassland in the northeast corner of the study area. Only six other sites are known for this species in Alberta.
Juncus longistylis Torr. Scarce along creeks.

LILIACEAE

Allium textile Nels. & Macbr. Occasional in exposed grasslands along coulees.
Disporum trachycarpum (S. Wats.) B. & H. Occasional in shrub thickets and coulee woodlands.
Lilium philadelphicum L. Locally common in ungrazed fescue grassland, especially in the northeast corner of the study area; eliminated by grazing.
Smilacina racemosa (L.) Desf. Cordilleran species noted only in shrub thickets along Willow Creek.
Smilacina stellata (L.) Desf. Common in shrub thickets and woodlands.
Zigadenus elegans Pursh Scarce in fescue grassland and moist coulee slopes.
Zigadenus venenosus S. Wats. Locally common in fescue grassland; particularly abundant in some wet years.

IRIDACEAE

Sisyrinchium montanum Greene Widespread in fescue grassland.

ORCHIDACEAE

Habenaria viridis (L.) Br. Scarce in low shrubs and dense fescue on slopes in vicinity of conglomerate outcrops.

SALICACEAE

Populus tremuloides Michx. Forms small clones in the northeast corner of the study area and small stands along the coulees leading into Willow Creek.
Salix bebbiana Sarg. Dominant willow of shrub thickets and depressions in fescue grassland.
Salix exigua Nutt. Common along creeks.
Salix petiolaris J.E. Smith Found only around one slough in northeast corner of study area, where it is common.

URTICACEAE

Urtica dioica L. Occasional in aspen woodland and shrub thickets.

SANTALACEAE

Comandra umbellata (L.) Nutt. Fairly common along coulee slopes.

POLYGONACEAE

Eriogonum flavum Nutt. Occasional along coulee slopes.
Polygonum amphibium L. Locally abundant in sloughs.
Polygonum douglasii Greene Occasional in alkaline seeps and clay pan areas in solonetzic soils near Little Fish Lake.
Rumex occidentalis S. Wats. Occasional in wet meadows/sloughs.
Rumex triangulivalvis (Dans.) Rech. f. Occasional in wet meadows/sloughs.

CHENOPODIACEAE

Atriplex nuttallii S. Wats. Common in badlands.
Chenopodium salinum Standl. Noted only along the shore of Little Fish Lake.
Eurotia lanata (Pursh) Moq. Occasional in badlands.
Monolepis nuttalliana (Schultes) Greene Occasional along seepage areas.
Suaeda calceoliformis (Hook.) Moq. Scarce in seepage areas.

CARYOPHYLLACEAE

Cerastium arvense L. Leading forb in fescue grasslands.
Moehringia lateriflora (L.) Fenzl. Occasional in shrub thickets.
Paronychia sessiflora Nutt. Occasional in exposed grasslands.
Silene drummondii Hook. Widespread, but never abundant, in fescue

grasslands.
Stellaria longipes Goldie Occasional along creeks and wet meadows.

RANUNCULACEAE

Actaea rubra (Ait.) Willd. Occasional in shrub thickets.
Anemone canadensis L. Fairly common along creeks and in shrub thickets.
Anemone cylindrica A. Gray Occasional in fescue grasslands.
Anemone multifida Poir. Occasional in drier grasslands.
Anemone patens L. Leading forb of fescue grasslands.
Ranunculus cardiophyllus Hook. Locally common in depressions in fescue grasslands.
Ranunculus cymbalaria Pursh Common along creeks and spring/seepage areas.
Ranunculus pedatifidus J.E. Smith Rare in fescue grasslands.
Ranunculus rhomboideus Goldie Uncommon in moist grasslands.
Thalictrum venulosum Trel. Common in coulee shrubbery and woodland; also locally common in fescue grassland depressions, particularly around aspen clones.

CRUCIFERAE

Arabis divaricarpa A. Nels. Occasional in grassland.
Arabis hirsuta (L.) Scop. Occasional in moist grassland.
Arabis holboellii Hornem. var. retrofracta (Graham) Rydb. Occasional in coulee grassland.
Draba nemorosa L. Occasional on sandy soil in grassland.
Erysimum inconspicuum (S. Wats.) MacM. Occasional in grassland.
Lesquerella arenosa (Richards.) Rydb. Uncommon along coulees.

SAXIFRAGACEAE

Heuchera richardsonii R.Br. Widespread but not abundant in fescue grassland.

GROSSULARIACEAE

Ribes americanum Mill. Scarce in coulee shrubbery and woodlands.
Ribes oxyacanthoides L. Fairly common in coulee shrubbery and woodlands.

ROSACEAE

Amelanchier alnifolia Nutt. Fairly common in coulee shrubbery and woodlands.
Chamaerhodos erecta (L.) Bunge Locally common on exposed sandy or gravelly sites.
Fragaria vesca L. Reported by Natural Areas Program.
Fragaria virginiana Duchesne Locally abundant in coulee shrubbery and woodlands.
Geum allepicum Jacq. Scarce along creeks.
Geum macrophyllum Willd. Reported by Natural Areas Program.
Geum triflorum Pursh Locally abundant in fescue grasslands, increasing

with light grazing.
Potentilla anserina L. Common along creeks and shore of Little Fish Lake.
Potentilla arguta Pursh Fairly common in fescue grassland depressions in the northeast corner.
Potentilla bipinnatifida Dougl. ex Hook. Occasional in fescue grassland depressions in the northeast corner.
Potentilla concinna Richards. Widespread but not abundant in grasslands.
Potentilla gracilis Dougl. ex Hook. Fairly common in fescue grassland depressions.
Potentilla hippiana Lehm. Scarce in grasslands.
Potentilla norvegica L. Occasional on disturbed wet soil.
Potentilla pensylvanica L. Occasional in grasslands.
Prunus pensylvanica L.f. Reported by Natural Areas Program.
Prunus virginiana L. Common in coulee shrubbery and woodlands.
Rosa arkansana Porter Fairly common along coulee slopes.
Rosa woodsii Lindl. Common in coulee shrubbery and woodlands.
Rubus idaeus L. Uncommon in coulee shrubbery and woodlands.

LEGUMINOSAE

Astragalus bisulcatus (Hook.) A. Gray Occasional in fescue grasslands and coulees; locally abundant in lightly grazed mixed grassland.
Astragalus crassicarpus Nutt. Scarce in fescue grasslands.
Astragalus dasyglottis Fisch. ex DC. Fairly common in grasslands.
Astragalus drummondii Dougl. ex Hook. Occasional in drier grasslands.
Astragalus flexuosus Dougl. ex G.Don Occasional in ungrazed grasslands.
Astragalus gilviflorus Sheldon Rare in badlands along Willow Creek.
Astragalus missouriensis Nutt. Occasional in drier grasslands.
Astragalus pectinatus Dougl. ex Hook. Scarce in drier grasslands, particularly on solonetzic soils.
Astragalus striatus Nutt. Occasional in drier grasslands.
Astragalus tenellus Pursh Occasional in coulee and mixed grasslands.
Glycyrrhiza lepidota (Nutt.) Pursh Fairly common along coulee bottoms; also found in upland grasslands on sandy or gravel soils.
Hedysarum alpinum L. Common in fescue grasslands, especially in depressions in the northeast corner; eliminated by heavy grazing.
Hedysarum boreale Nutt. Present in coulee grasslands.
Lathyrus ochroleucus Hook. Fairly common in coulee shrubbery and woodlands.
Oxytropis monticola A. Gray Occasional in grasslands.
Oxytropis sericea Nutt. Occasional in coulee grasslands.
Psoralea esculenta Pursh Scarce on dry slopes of coulees.
Thermopsis rhombifolia (Nutt.) Richards. Leading forb in grasslands.
Vicia americana Muhl. Fairly common in coulee shrubbery and in fescue grasslands.

LINACEAE

Linum lewisii Pursh Fairly common in drier grasslands.

MALVACEAE

Sphaeralcea coccinea (Pursh) Rydb. Occasional on coulee slopes.

VIOLACEAE

Viola adunca J.E. Smith Occasional on moist coulee slopes.
Viola nuttallii Pursh Occasional on dry coulee slopes.
Viola pedatifida G. Don One of five known localities in Alberta. Found in only a handful of sites in ungrazed fescue grassland.
Viola canadensis L. Uncommon in coulee shrubbery and woodlands.

CACTACEAE

Opuntia polyacantha Haw. Common along coulee slopes.

ELAEAGNACEAE

Elaeagnus commutata Bernh. ex Rydb. Dominant on some areas of gravelly or sandy glaciofluvial deposits along the western boundary.
Shepherdia argentea Nutt. Occasional in coulee shrubbery.
Shepherdia canadensis (L.) Nutt. Dominant shrub on some coulee slopes; especially abundant on the hill in the southeast corner.

ONAGRACEAE

Epilobium angustifolium L. Locally abundant in depressions in fescue grassland.
Gaura coccinea Pursh Occasional in drier grasslands.
Oenothera biennis L. Rare in moister sites along coulees and disturbed grasslands.
Oenothera breviflora T. & G. Rare along the shore of Little Fish Lake. One of only three known localities in Alberta.
Oenothera nuttallii Sweet Occasional in grasslands, especially on sandy soil.

UMBELLIFERAE

Cicuta maculata L. Rare in moist sites along coulees.
Cymopterus acaulis (Pursh) Raf. Scarce on dry coulee slopes.
Lomatium foeniculaceum (Nutt.) Coult. & Rose Occasional in drier grasslands.
Musineon divaricatum (Pursh) Nutt. Occasional in drier grasslands.
Zizia aptera (A. Gray) Fern. Locally common in depressions in fescue grassland.

CORNACEAE

Cornus stolonifera Michx. Common in coulee shrubbery and woodlands.

PYROLACEAE

Pyrola asarifolia Michx. Occasional in coulee shrubbery and woodlands.

ERICACEAE

Arctostaphylos uva-ursi (L.) Spreng. Fairly common on moist coulee slopes.

PRIMULACEAE

Androsace septentrionalis L. Widespread, but not abundant, in grasslands.
Dodecatheon conjugens Greene Occasional in fescue grassland.
Dodecatheon pulchellum (Raf.) Merr. Local, in saline seeps.
Glaux maritima L. Fairly common in saline seeps.
Primula incana M.E. Jones Scarce, along moist coulee bottoms.

GENTIANACEAE

Gentianella amarella (L.) Borner Frequent in moist fescue grassland and moist coulee slopes.

POLEMONIACEAE

Collomia linearis Nutt. Uncommon on dry grassland slopes and exundated slough bottoms.
Phlox hoodii Richards. Leading forb species in drier grasslands.

BORAGINACEAE

Cryptantha fendleri (A. Gray) Greene Present on summit of hill in southeast corner of study area on eroding slopes.
Hackelia americana (A. Gray) Fern. Occasional in shrub thickets.
Lappula occidentalis (S. Wats.) Greene Occasional in drier and heavily grazed grasslands.
Lithospermum incisum Lehm. Occasional in drier grasslands.
Plagiobothrys scouleri (H. & A.) Johnston Rare on sandy dry grassland sites.

LABIATAE

Mentha arvensis L. Uncommon in wet meadows and along creeks.
Stachys palustris L. Scarce in wet meadows and along creeks.

SOLANACEAE

Solanum triflorum Nutt. Scarce on disturbed soil in grasslands, mostly on ground squirrel diggings.

SCROPHULARIACEAE

Castilleja lutescens (Greenm.) Rydb. Cordilleran species, locally abundant in fescue grassland, especially in the northeast corner.
Orthocarpus luteus Nutt. Occasional in drier and heavily grazed grasslands.
Penstemon nitidus Dougl. ex Benth. Uncommon along coulee slopes.
Penstemon procerus Dougl. ex Grah. Locally abundant in fescue

grasslands, especially depressions.

OROBANCHACEAE

Orobanche fasciculata Nutt. Reported by Owens (1970) in grazed grassland.

PLANTAGINACEAE

Plantago elongata Pursh Only six other known localities in Alberta. Occasional in saline seeps.
Plantago eriopoda Torr. Fairly common in saline seeps.
Plantago patagonica Jacq. var. patagonica Locally abundant on badland pediment slopes.

RUBIACEAE

Galium boreale L. Leading forb species of depressions in fescue grassland.

CAPRIFOLIACEAE

Lonicera dioica L. Occasional in coulee shrubbery and woodland.
Symphoricarpos albus (L.) Blake Occasional in coulee woodlands.
Symphoricarpos occidentalis Hook. Dominant species of low shrub thickets.

CAMPANULACEAE

Campanula rotundifolia L. Widespread in grasslands.

COMPOSITAE

Achillea millefolium L. Occasional in grasslands, particularly ungrazed sites.
Agoseris glauca (Pursh) Raf. Occasional in fescue grassland.
Antennaria aprica Greene Locally abundant in heavily grazed grasslands.
Antennaria parviflora Nutt. Reported by Natural Areas Program.
Arnica fulgens Pursh Locally abundant in fescue grassland depressions.
Artemisia cana Pursh Common in badland areas.
Artemisia campestris L. Fairly common in coulees.
Artemisia frigida Willd. Widespread in grasslands, abundant on heavily grazed sites.
Artemisia longifolia Nutt. Common in badlands.
Artemisia ludoviciana Nutt. Common in fescue grasslands.
Aster brachyactis Blake Fairly common in saline seeps.
Aster ciliolatus Lindl. Rare in coulee woodlands.
Aster ericoides L. Occasional in grasslands; increasing with grazing.
Aster falcatus Lindl. Occasional in grasslands.
Aster hesperius A. Gray Occasional in wet meadows and along moist stream channels in coulees.
Aster laevis L. Fairly common in moist fescue grassland, coulee shrubbery and woodlands.

Cirsium flodmanii (Rydb.) Arthur Occasional in coulee grasslands.
Cirsium undulatum (Nutt.) Spreng. Rare in drier grasslands.
Erigeron caespitosus Nutt. Fairly common in drier grasslands.
Erigeron compositus Pursh Locally abundant on gravelly, sandy sites in grasslands in the northwest corner and on the hill in the southeast corner.
Erigeron glabellus Nutt. ssp. pubescens (Hook.) Cronq. Fairly common in fescue grasslands and shrub thickets.
Erigeron pumilus Nutt. Scarce in badlands and drier grasslands.
Gaillardia aristata Pursh Occasional in grasslands.
Grindelia squarrosa (Pursh) Dunal Fairly common in exposed clay flats and saline seeps, also on solonetzic soils near Little Fish Lake.
Gutierrezia sarothrae (Pursh) Bitt. & Rusby Fairly common on dry exposed slopes.
Haplopappus lanceolatus (Hook.) T. & G. Local in alkaline seeps.
Haplopappus spinulosus (Pursh) DC. Occasional in drier grasslands.
Helianthus nuttallii T. & G. Occasional along creeks.
Helianthus subrhomboideus Rydb. Locally abundant in forb depressions in northeast corner fescue grasslands.
Heterotheca villosa (Pursh) Shinners Common in dry grasslands.
Hieracium umbellatum L. Occasional in coulee shrubbery and fescue grassland in northeast corner.
Hymenoxys richardsonii (Hook.) Cockerell Occasional on coulee slopes.
Iva axillaris Pursh Locally abundant in badlands and alkaline seeps.
Lactuca pulchella (Pursh) DC. Occasional in moist grasslands.
Liatris punctata Hook. Uncommon in drier grasslands.
Lygodesmia juncea (Pursh) D. Don Occasional in grasslands.
Senecio canus Hook. Occasional on coulee slopes and drier grasslands.
Solidago canadensis L. Fairly common in moist coulee slopes and depressions in fescue grassland.
Solidago missouriensis Nutt. Widespread in grassland depressions.
Solidago spathulata DC. Occasional along coulee slopes.

APPENDIX 2: ANNOTATED LIST OF MAMMALS

The following list of 16 species is derived from 1984 field work, visits by the authors from 1972 to 1983, and field notes of C.R. Wershler when he worked as a field assistant to R.A. Owens in a study of grassland birds. Eleven of these species were recorded in 1984. Species order and nomenclature is based on Banfield (1974).

Nuttall's Cottontail - present in old farm windbreak at northeast end of study area; not observed in coulees.

White-tailed Jack Rabbit - only one observed in 1984, in thick fescue at north end of study area; in other years most commonly seen in grazed grassland.

Least Chipmunk - four in coulees just west of study area, June 12.1984. Observed within study area in coulee shrubbery in 1977.

Richardson's Ground Squirrel - mostly restricted to grazed grassland. Less common in 1984 than in 1970; most abundant along north-south road just northwest of Little Fish Lake.

Thirteen-lined Ground Squirrel - less common in 1984 than in 1970, frequenting ungrazed as well as mowed grassland.

Northern Pocket Gopher - noted in fescue grassland in 1977.

American Beaver - active dam in northwest extremity of study area was the only sign of this species.

Deer Mouse - observed around old buildings in 1970; undoubtedly present in a variety of wooded and grassland habitats, but only trapping or winter tracking will confirm this.

Meadow Vole - occurs along edges of wetlands and streams, in grassy coulee bottoms, depressions in grasslands, and low shrubbery.

American Porcupine - present in tall shrubbery and woods, sometimes taking shelter in holes in coulee walls. In 1970, a very young one was found in an aspen clone in the northwest corner of study area.

Coyote - present throughout study area in a wide variety of habitats; most commonly seen just northwest of Little Fish Lake in the vicinity of ground squirrel colonies. In 1970, an occupied den was found in a coulee in the central portion of study area.

Long-tailed Weasel - one at a ground squirrel colony in the southeast corner of study area in 1970.

American Badger - none seen in 1984, but fresh diggings were noted along the northwest edge of study area. Found in 1974 in the heavily grazed area of solonetzic soil northwest of Little Fish Lake.

Mule Deer - regularly seen in coulees, and occasionally in shrubby upland.

White-tailed Deer - occurs in aspen clones in grassland, as well as wooded coulees.

Pronghorn - most common in mixed grassland in the northwest part of the study area, with up to 19 seen in one day. Occasional in grassland in the western part of study area.

APPENDIX 3: ANNOTATED LIST OF BIRDS

This list is based on field work conducted in 1984, visits by the authors from 1972 to 1973, field notes of W.W. Smith employed by Alberta Parks to study the Little Fish Lake area in 1974, and field notes of C.R. Wershler who assisted R.A. Owens in a study of effects of agriculture on grassland birds in 1970. A total of 131 species have been recorded in, or in the immediate vicinity of, the study area. Eighty-one species were recorded in 1984. Nesting evidence exists for 49 species, designated with an asterisk (*). Nomenclature is based on the A.O.U. Checklist of North American Birds, 6th Edition, 1983.

Common Loon - summer visitor and migrant. A pair on May 31, 1970, in courtship flight over grassland in southeast corner of study area. One on June 19, 1974 and three on June 5, 1981 at northwest end of Little Fish Lake.

Horned Grebe - summer visitor in 1970 and 1974 at northwest end of Little Fish Lake.

Eared Grebe - summer visitor in 1970 and 1974 at northwest end of Little Fish Lake.

Western Grebe - summer visitor in 1970 and 1974 at northwest end of Little Fish Lake.

American White Pelican - summer visitor at northwest end of Little Fish Lake.

Double-crested Cormorant - summer visitor to northwest end of Little Fish Lake.

Great Blue Heron - summer visitor. One at small pond in central portion of study area, August 18, 1984.

Tundra Swan - migrant. One record of a small number flying over, April 25, 1970.

Snow Goose - migrant, mostly in fall. Large flock, October, 1972 and flock of several hundred on October 3, 1984, both resting along northwest shore of Little Fish Lake on portions of shore not accessible to cattle.

Canada Goose - summer visitor at northwest end of Little Fish Lake, usually in small numbers along the northwest shore.

*Green-winged Teal - summer resident around ponds and Little Fish Lake.

*Mallard - summer resident around ponds and Little Fish Lake.

*Northern Pintail - summer resident around ponds and Little Fish Lake, often nesting a good distance from water. Nest found in ungrazed fescue in 1970.

*Blue-winged Teal - summer resident around ponds and Little Fish Lake. Nest found in ungrazed fescue in 1970.

Cinnamon Teal - summer visitor. One male, late May, 1974, at northwest end of Little Fish Lake; two pairs also seen in 1977 on alkaline ponds in southwestern portion of study area.

*Northern Shoveler - summer resident around ponds and Little Fish Lake. Two nests in ungrazed fescue in 1970.
*Gadwall - summer resident around ponds and Little Fish Lake.
*American Wigeon - summer resident around ponds and Little Fish Lake.
Canvasback - summer visitor. One record, June 5, 1981 on Little Fish Lake.
Redhead - summer visitor. Two records, May 22, 1974 and June 5, 1981 at northwest end of Little Fish Lake.
Lesser Scaup - summer visitor around ponds and Little Fish Lake, possibly nesting.
White-winged Scoter - summer visitor, 1974 and 1977, at northwest end of Little Fish Lake.
Common Goldeneye - summer visitor, 1974, at northwest end of Little Fish Lake. One record of a pair, June 5, 1981.
Bufflehead - summer visitor to northwest end of Little Fish Lake and, in 1984, at large pond in southwest corner of study area.
Red-breasted Merganser - migrant. One female observed June 5, 1981.
Bald Eagle - migrant. One adult and one immature moving south over area, October 3, 1984.
Northern Harrier - summer resident, probably nests in the area. In 1970 and 1974 often seen in vicinity of low shrub communities in ungrazed fescue just west of the northwest end of Little Fish Lake. Feeds over grassland with various types of grazing regimes.
Sharp-shinned Hawk - migrant. Observed migrating high overhead as well as in aspen clones.
Cooper's Hawk - migrant. Two individuals flying south, October 3, 1974.
*Swainson's Hawk - summer resident, nesting in coulee woods and aspen clones along north and west edges of study area. Apparently more common in 1984 than in 1970.
*Red-tailed Hawk - summer resident, nesting in aspen clones and coulee woods. Apparently less common in 1984 than in 1970. On October 3, 1984, a total of 15 observed migrating south, over the area, during a two-hour period.
*Ferruginous Hawk - summer visitor, possibly nesting in aspen clones or badlands just outside the study area. Most often seen flying over the north part of study area. At least four old nests along Willow Creek badland slopes in northwest part of study area.
Rough-legged Hawk - migrant. Total of eight migrating south during a two-hour period, October 3, 1984.
Golden Eagle - visitor. One flying high over study area, June 1, 1984, in direction of Willow Creek badlands.
American Kestrel - summer visitor to western edge of study area; nesting just west of study area in badlands in 1974.
*Merlin - summer resident and possible year-round resident, nesting in aspen clones in mowed and ungrazed fescue, along northwestern edge of study area. Only two seen and one possible nest found in 1984. At least three active nests in 1974.
Peregrine Falcon - migrant. One adult (anatum) on northwest shore of Little Fish Lake, late May 1981. It took off at a great height to the north.
Prairie Falcon - summer visitor, possibly nesting in badlands of Willow Creek near study area boundary.
*Sharp-tailed Grouse - resident in lush grasslands and in low shrubbery in coulees. Considerably less common in 1984 than in 1970. No

evidence, in last three years, of use of a dancing ground in the southeast corner of the study area which was used in 1970.

Sandhill Crane - migrant. One small flock overhead, April, 1970, and a pair, June 13, 1984, flying low over southeast portion of study area and eventually catching a thermal and soaring at a great height to west-northwest.

Black-bellied Plover - migrant along northwest shore of Little Fish Lake, observed in late May and early June.

Lesser Golden Plover - migrant. Small numbers flying over area, May, 1970.

*Piping Plover - summer resident along undisturbed pebbly lakeshore. Nested in 1974. At least two nesting pairs (seven adults in total) along northwest shore of Little Fish Lake in late May, 1981. However, in June of that year, large numbers of cattle were given access to the area. Heavy trampling apparently destroyed nests and eggs and only two adults remained in general vicinity. In 1984, the area was still heavily used by cattle, with even more shoreline accessible to cattle. No birds were seen, but it is possible that they were present southeast of this site, along undisturbed portions of shore.

Semipalmated Plover - migrant. One record of two birds, May 12, 1981.

*Killdeer - summer resident along shores of Little Fish Lake and ponds.

*American Avocet - summer resident along shores and on islands (when formed) at northwest end of Little Fish Lake.

Lesser Yellowlegs - migrant. Small flocks, early July, 1974, on northwest shore of Little Fish Lake.

Solitary Sandpiper - migrant. Two on northwest shore of Little Fish Lake, July 17, 1984.

*Willet - summer resident along shores of ponds and Little Fish Lake.

Spotted Sandpiper - summer resident along shoreline of large pond at southwest edge of study area in 1984; probably nests.

*Upland Sandpiper - local summer resident in lush grassland and old undisturbed lakeshore. Loose colonies, in low-lying undisturbed fescue in 1970 and on old lakeshore at northwest end of Little Fish Lake in 1981, were no longer present in 1984 due to heavy cattle use.

Long-billed Curlew - summer resident, in 1970, just east of southeast corner of study area, nesting in recently mowed fescue. Present in heavily grazed grasslands in southwestern corner of study area in 1974.

*Marbled Godwit - summer resident along shores of Little Fish Lake, and also present at large pond at southwest edge of study area.

Sanderling - migrant along northwest shore of Little Fish Lake.

Semipalmated Sandpiper - migrant. Small flocks along northwest shore of Little Fish Lake, July, 1974.

Least Sandpiper - migrant. Small flocks along northwest shore of Little Fish Lake, July, 1974.

Baird's Sandpiper - migrant, along northwest shore of Little Fish Lake and at small ephemeral ponds in fescue grassland.

Pectoral Sandpiper - migrant. One on northwest shore of Little Fish Lake, July 10, 1974.

Short-billed Dowitcher - migrant. Two on northwest shore of Little Fish Lake, July 17, 1974.

Long-billed Dowitcher - migrant. Two flocks on northwest shore of

Little Fish Lake, July, 1974.

Common Snipe - summer resident. Probably nesting, in 1970 and 1974, along creek at northwest corner of Little Fish Lake. Absent in 1984 probably due to drought and cattle disturbance of wetland.

Wilson's Phalarope - summer resident along northwest shore of Little Fish Lake and edges of large pond at southwest edge of study area. Probably nests.

Franklin's Gull - summer visitor to Little Fish Lake.

Ring-billed Gull - summer visitor to Little Fish Lake.

California Gull - summer visitor to Little Fish Lake.

Herring Gull - migrant. Noted in spring at Little Fish Lake.

*Common Tern - summer resident at Little Fish Lake, nesting on small island just off northwest shore in 1981. Following a series of dry years, this island no longer existed in 1984 due to a drop in lake's water level.

Black Tern - summer visitor to ponds and Little Fish Lake.

*Mourning Dove - summer resident in vicinity of wooded coulees. Most common along western edge of study area.

Black-billed Cuckoo - summer visitor. One in old farm windbreak, July 11, 1974.

*Great-horned Owl - resident, nesting in coulee woodland and aspen clones on upland. Two individuals seen in 1974.

Short-eared Owl - summer visitor in 1974 to lush drainage just west of northwest end of Little Fish Lake.

Common Nighthawk - summer resident. Only one recorded in 1984, along Willow Creek badlands at western edge of study area. Possibly nests.

Hairy Woodpecker - visitor. One in aspen clone in northwest portion of study area, August 17, 1984.

Alder Flycatcher - summer visitor, possible summer resident. One in lush mixed coulee shrubbery, June 12, 1984, south of Willow Creek just west of study area.

*Least Flycatcher - summer resident in aspen clones in fescue grassland and in coulee aspen woods.

Say's Phoebe - summer resident in badlands along Willow Creek at northwestern edge of study area. Probably nests.

*Eastern Kingbird - summer resident in lush shrubbery in coulee bottoms, often near water.

*Horned Lark - summer resident in grazed grassland.

*Tree Swallow - summer resident, occasional in coulee aspen woods.

Northern Rough-winged Swallow - summer resident, occasional along coulees and creeks in western portion of study area. Probably nests in low creek banks.

*Cliff Swallow - summer resident. Nested, in 1970, on side of old farm house in southwest corner of study area. Feeds over Willow Creek valley where it probably nests on steep cliff faces.

*Barn Swallow - summer resident, nesting on old buildings.

*Black-billed Magpie - resident in tall coulee shrubbery and, to a lesser extent, in aspen clones in grassland.

*American Crow - summer resident in aspen clones and coulee woods. Large flocks in aspen clones at north edge of study area, August 16, 1984.

*Black-capped Chickadee - resident in wooded coulees, occasionally visiting aspen clones in grassland.

Red-breasted Nuthatch - summer visitor. In 1984, total of three observed in two large aspen clones in northeast corner of study area. Possibly nested.

Rock Wren - summer resident in badlands of Willow Creek, and one singing, in 1984, in scattered conglomerate outcrops in southeast corner of study area. Probably nests.

*House Wren - summer resident in wooded coulees and, to a lesser extent, in aspen clones in grassland.

Mountain Bluebird - summer resident along Willow Creek, probably nesting in badlands.

Gray-cheeked Thrush - migrant. One collected in late May, 1970, in old farm windbreak.

Swainson's Thrush - migrant. Several in old farm windbreak, late May, 1970.

American Robin - summer resident. Local in wooded coulees, likely breeding.

Ruby-crowned Kinglet - migrant. One male singing in aspen clone, June 5, 1981.

*Gray Catbird - summer resident in tall coulee shrubbery.

*Brown Thrasher - summer resident in tall coulee shrubbery, including drier areas than inhabited by former species.

Water Pipit - migrant. Small numbers flying over, May, 1970.

*Sprague's Pipit - summer resident in ungrazed or lightly grazed grassland.

*Cedar Waxwing - summer resident in tall coulee shrubbery.

Loggerhead Shrike - summer visitor along north-south road at northwest edge of study area. Nested in vicinity of north boundary in 1974.

European Starling - summer visitor in vicinity of recently heavily grazed areas in grassland.

Warbling Vireo - summer resident in coulee woodland and, to a lesser extent, aspen clones in grassland; probably breeds. Not recorded in 1970.

*Red-eyed Vireo - summer resident in coulee woodland and aspen clones in grassland.

Orange-crowned Warbler - summer visitor. One singing, May 31, 1984, in young aspen-tall shrubbery on north-facing slope on south side of Willow Creek valley, just west of study area.

*Yellow Warbler - summer resident in tall shrubbery and woodland understory of coulees and, to a lesser extent, in aspen clones in grassland.

Yellow-rumped Warbler ("Myrtle" subspecies) - migrant, noted in old farm windbreak and aspen clones in spring and fall.

Blackpoll Warbler - migrant. Several in old farm windbreak in May, 1970.

Common Yellowthroat - summer resident. Restricted to lush low shrubbery along beaverpond and creeklet in northwest corner of study area; probably nests. Occasional summer visitor to low shrub communities in lush grassland.

*Rufous-sided Towhee - summer resident in tall shrubbery of coulees.

American Tree Sparrow - migrant. Several in early May, 1970, in old farm windbreak.

Chipping Sparrow - migrant and possible summer resident. Several in old farm windbreak, May 19, 1970, and one in same habitat, July 17, 1974.

*Clay-colored Sparrow - summer resident in low shrub communities of coulees and lush grassland and in silverberry stands, as well as scattered willows in the vicinity of aspen clones in grassland.
*Vesper Sparrow - summer resident on lush unwooded coulee slopes and shrubby mixed grassland. Most common in northwest part of study area.
*Savannah Sparrow - summer resident in lush ungrazed grassland, especially on protected slopes and in depressions, and in grassy stream and pond edges.
*Baird's Sparrow - summer resident, restricted to ungrazed and lightly grazed grassland.
LeConte's Sparrow - summer visitor and possible summer resident. One singing male in tall grass of creek bottom in northwest portion of study area, June 12 and 20, 1984; possibly nested.
Song Sparrow - migrant. One in old farm windbreak, May 19, 1970.
White-crowned Sparrow - migrant. A few in old farm windbreak, May, 1970.
Harris' Sparrow - migrant. A few in old farm windbreak, May, 1970.
Dark-eyed Junco ("Slate-colored" subspecies) - migrant. A few in old farm windbreak, May, 1970.
Lapland Longspur - migrant. A few small groups passing over, April, 1970.
Smith's Longspur - migrant. One small flock flying over grassland in northeast portion of study area, May, 1970.
*Chestnut-collared Longspur - summer resident in 1970 and 1977 in recently mowed fescue and heavily grazed fields, at eastern edge of study area. Not observed in 1984.
*Red-winged Blackbird - summer resident in damp shrubbery next to water, in coulee and creek bottoms.
*Western Meadowlark - summer resident in ungrazed to moderately grazed grassland.
*Brewer's Blackbird - local summer resident in low coulee shrubbery, mostly in northwest part of study area.
*Brown-headed Cowbird - summer resident, most often seen in vicinity of cattle and in woodlands. A nest parasite on various species of woodland and grassland passerines.
*Northern Oriole ("Baltimore" subspecies) - summer resident in aspen woods in coulees and aspen clones in grassland.
Pine Grosbeak - visitor. One record of a female in old farm windbreak, May 19, 1970.
Red Crossbill - summer visitor in 1984; one immature male feeding at edge of dry sedge marsh, and several flying in vicinity of aspen clones in grassland. Small groups seen in August, 1974 feeding in aspen.
Pine Siskin - summer visitor, recorded in aspen clones, August 17, 1984.
*American Goldfinch - summer resident in lush shrubbery, often near water.

APPENDIX 4: ANNOTATED LIST OF REPTILES AND AMPHIBIANS

This list is based on field work in 1984, as well as the authors' field notes from 1970 to 1983, and field notes of W.W. Smith from 1974. Only one species was recorded in 1984.

Common (Red-sided) Garter Snake - recorded in 1970 in northeast corner of study area and in grassland between aspen clones; an unidentified garter snake was seen in the same area in 1984.

Chorus Frog - frequents upland ponds and puddles in coulee bottoms throughout study area.

Leopard Frog - recorded in 1970 at a pond in or near northeast part of study area.

APPENDIX 5: 1984 LITTLE FISH LAKE PLANT COLLECTIONS

The following is a list, by collection locality and date, of all plants collected in the Little Fish Lake study area during the 1984 field season. Specimens have been placed with the Natural Areas Program.

May 31

Little Fish Lake Sand Plain (west boundary)

- spear grass/silverberry community

Potentilla concinna Richards.

- coulee shrubbery

Zizia aptera
Salix bebbiana
Moehringia lateriflora

- ground squirrel hole

Androsace septentrionalis

- ungrazed Agropyron-Stipa grassland

Carex obtusata
Carex douglasii

- coulee grassland, south-facing slope

Carex praticola

Willow Creek (northwest boundary)

- streamside

Carex lanuginosa
Carex pensylvanica var. digyna
Carex praegracilis
Ranunculus cymbalaria

- coulee grassland, south-facing slope

Poa cusickii

- spring/seepage area

Plantago eriopoda
Iva axillaris
Plantago elongata

- heavily grazed coulee grassland, south-facing slope

Carex stenophylla

- south-facing grassland, dry slope

Allium textile
Antennaria aprica
Lithospermum incisum
Collomia linearis
Comandra umbellata
Arabis hirsuta
Carex *filifolia*
Carex pensylvanica var. digyna
Cymopterus acaulis
Oxytropis monticola
Oxytropis sericea
Chamaerhodos erecta
Psoralea esculenta
Lappula occidentalis
Astragalus drummondii
Astragalus bisulcatus
Astragalus dasyglottis
Erysimum inconspicuum
Penstemon nitidus
Lomatium foeniculaceum
Vicia americana
Arabis divaricarpa
Atriplex nuttallii
Monolepis nuttalliana
Poa cusickii
Carex stenophylla
Stipa viridula
Koeleria macrantha

Northwest corner, east of Willow Creek on uplands
- depression in grassland
Ranunculus cardiophyllus
Carex praticola

- wet coulee crossing
Carex praegracilis

June 1
Centre block along drainage channel
- coulee southwest of corrals
Draba nemorosa
Carex praegracilis

June 12
Northwest corner along Willow Creek
- beaver ponds
Lonicera dioica
Salix exigua
Astragalus tenellus
Potentilla concinna
Hedysarum alpinum
Castilleja lutescens
Stipa viridula
Poa interior

Bromus inermis
Carex xerantica

- aspen woods along slope
Agrostis stolonifera
Carex sprengellii

June 13
Little Fish Lake
- shoreline
Stellaria longipes
Glaux maritima
Chenopodium salinum
Juncus balticus
Scirpus pungens
Eleocharis palustris

Southwest corner, hill system
- southwest facing dry hill north-northeast of gravel pit
Erigeron compositus

- hillside shrubbery north-northeast of gravel pit
Habenaria viridis

- conglomerate slopes on hill north-northeast of gravel pit
Chamaerhodos erecta

- buffaloberry slopes with low shrubs and forb patches
Hedysarum alpinum
Ranunculus rhomboideus
Castilleja lutescens
Arabis hirsuta
Penstemon procerus
Stipa viridula
Festuca scabrella
Poa cusickii
Carex siccata

June 20
Northeast corner
- mowed fescue grassland
Erigeron glabellus ssp pubescens

August 16
Northeast corner
- forb-rich depression in fescue grassland
Silene drummondii
Carex siccata
Helianthus subrhomboideus
Lilium philadelphicum
Castilleja lutescens
Northwest corner
- lightly grazed fescue along north boundary
Potentilla hippiana

Astragalus flexuosus
Haplopappus spinulosus

- #5 alkaline seepage, north boundary
Erigeron pumilus
Aster brachyactis
Haplopappus lanceolatus
Monolepis nuttalliana
Atriplex cf. nuttalliana
Triglochin palustris
Muhlenbergia cuspidata
Poa arida
Agropyron trachycaulum
Puccinellia nuttalliana
Hordeum jubatum

August 17

Northeast corner

- Carex atherodes slough edge
Salix petiolaris
Aster hesperius
Potentilla norvegica
Stachys palustris
Mentha arvensis
Rumex occidentalis
Rumex triangulivalvis
Agrostis scabra
Beckmannia syzigachne
Carex arthrostachya

- sedge grass forb depression in fescue grassland
Juncus confusus
Agrostis scabra
Calamagrostis inexpansa
Danthonia californica
Carex praticola
Carex siccata

- thick fescue grassland
Carex xerantica

- forb-rich depression near fireweed stand
Potentilla bipinnatifida
Bromus inermis
Bromus anomalus

Centre block

- creekside south of corrals
Helianthus nuttallii
Juncus bufonius
Glyceria elata
Koeleria macrantha

Northwest corner
- aspen coulee, wet seepage
Polygonum douglasii

APPENDIX 6: FIELD NOTES

The following are unedited field notes typed from the original notes taped during the field surveys of 1984. All records are for the Little Fish Lake area.

May 31

NW along road allowance into study area
- Pronghorn, Upland Sandpiper, Meadowlark

Road allowance meets Willow Creek
- singing: 2 Rock Wrens, Vesper Sparrow, Meadowlark, Clay-colored Sparrow (buckbrush), Say's Phoebe
- Cowbird, Mountain Bluebird, Prairie Falcon, Brewer's Blackbird (pr. in low shrubs), Mourning Dove flew by, 3 old Ferruginous eyries here
- Deer tracks, Coyote tracks

Plants in bloom: Allium textile, Astragalus drummondii, Viola nuttallii, Carex filifolia, Psoralea (almost), Vicia sparsifolia, Penstemon nitidus, Arabis holboellii, Paronychia (almost), Phlox (finished), Comandra, Lomatium foeniculaceum (seed), Hymenoxys richardsonii (almost), Oxytropis monticola, Astragalus bisulcatus (almost), Linum lewisii, Anemone patens (seed heads), Cerastium arvense, Chamaerhodos in rocks (not blooming), Lesquerella, Eurotia lanata, Atriplex nuttallii, Plantago elongata and patagonica (saline badlands springs), Lappula, Erysimum inconspicuum, Carex obtusata, Geum triflorum, Senecio canus (headed), Collomia, Arabis hirsuta, Lithospermum incisum, Prunus virginiana (shrubs), Musineon (seed, gravelly slope), Astracalus agrestis, Antennaria aprica,

- along creek - Thermopsis, Potentilla anserina, Ranunculus cymbalaria, Elaeagnus commutata, Scirpus pungens, Juncus balticus, Eleocharis palustris, Triglochin maritima (not blooming), Equisetum arvense, Carex lanuginosa, Thalictrum venulosum (in shrubs)

badlands - Iva axillaris, Artemisia longifolia (not blooming), Plantago eriopoda, Spartina gracilis (not headed), Haplopappus lanceolatus

north along road allowance - Crow, Eastern Kingbird, 13 lined ground squirrel, 2 Mourning Doves, Horned Lark
Plants in bloom - Zigadenus venenosus, Ranunculus cardiophyllus and Carex praticola collected in wet depression

coming to creek heading southeast - Richardson's ground squirrel
creek - beaver, Eastern Kingbird

after mudhole - Red-tailed Hawk on upland fescue hunting

after next big creek valley - Upland Sandpiper in moderately grazed grassland

heading west along old road towards silverberry - 1 male and 1 female Pronghorn, 1 Pronghorn, Vesper Sparrows and Meadowlark in silverberry

plants in bloom - Carex obtusata (in less-grazed), Carex eleocharis (in heavily grazed), Carex filifolia (coulee sides)

shrub-woodland on south side of Willow Creek - just west of study area
birds singing: Yellow Warbler, Vesper Sparrow, Orange-crowned Warbler, Clay-colored Sparrow, Sprague's Pipit (grassland), Upland Sandpiper (grassland) Rufous-sided Towhee, Brown Thrasher; creek bottom - Red-winged Blackbird; badlands - Say's Phoebe, Western Meadowlark
- 2 Swainson's Hawk and Red-tailed Hawk, old Ferruginous nest, Cliff Swallows, Grouse feeding on silverberry
- 2 female deer, 2 male, porcupine sign
- Mourning Dove and Towhee in next coulee north
- Northern Harrier over grassland
- Coyotes in coulee

plants in bloom - Salix bebbiana, Shepherdia canadensis, Cornus stolonifera (almost), Smilacina racemosa (almost), Smilacina stellata, Amelanchier (finishing), Viola adunca, Fragaria virginiana, Disporum trachycarpum, Viola rugulosa, Cystopteris fragilis, Ribes oxyacanthoides (fruiting starting), Actaea rubra (not bloom), Cystopteris (not bloom), Zizia aptera, Pyrola asarifolia (not bloom), Ribes americanum (not bloom), Beckmannia (not bloom, in marsh), Carex sprengellii (clumps), Carex atherodes (not bloom), Axyris amaranthoides (badland), Gentianella (not bloom), Arabis hirsuta (in shrubs), Anemone canadensis (starting),

June 1
heading south and west from corrals to major coulee
- Sharp-tailed Grouse in ditch by gate on north south road
- Pronghorn in silverberry area
- singing: in coulee Clay-coloured Sparrow, Rufous-sided Towhee, Yellow Warbler, Vesper Sparrow

plants in bloom - Dodecatheon (upland), Astragalus missouriensis (in coulee), Shepherdia argentea (not blooming, in coulee), Draba nemorosa, Carex praegracilis

south on gas well road in sw corner
- 5 pronghorn

Willet, 15 Brewer's Blackbirds in grassland, 2 Mallards (creek)

slough - 4 L. Scaup, female Bufflehead, 15 Shoveler, 3 Marbled Godwit, 1 Gull, 4 Mallards, 3 GW Teal, 1 BW Teal, 5 W Phalarope, 6 Gadwall, 4 Wigeon

slough south - 6 Black Terns, 2 Crows, 2 Spotted Sandpiper, GW Teal, BW Teal

heavily grazed grassland - Horned Larks

viewpoint - Golden Eagle

Shore of Little Fish - 10 Black-bellied Plover, 2 Willet, C Terns, ducks in wind

June 12
NW road allowance meets Willow Creek
- singing: 2 Vesper Sparrow, 2 Western Meadowlark, 2 Rock Wren, Gray Catbird, Brown Thrasher, American Goldfinch, Sprague's Pipit, Clay-colored Sparrow
- Red-tailed Hawk, Say's Phoebe, Eastern Kingbird, 2 Rough-winged Swallow, Horned Lark, Brown-headed Cowbird

- in bloom: Psoralea esculenta, Astragalus drummondii, A. bisulcatus, Vicia, Collomia, Hymenoxys richardsonii, Comandra, Gaura, Sphaeralcea, Penstemon nitidus, Allium textile, Eriogonum flavum, Erysimum inconspicuum

Moderately grazed grassland
- good blooms of Zigadenus venenosus and Ranunculus cardiophyllus
- also in bloom: small Antennaria aprica, Geum triflorum, Arnica fulgens

Beaverpond
- singing: Gray Catbird, Brown Thrasher, Common Yellowthroat, Yellow Warbler, Clay-colored Sparrow, Red-winged Blackbird, Western Meadowlark, Vesper Sparrow
- American Goldfinch, Barn Swallow, male Northern Harrier, Killdeer, Cliff Swallow; young Meadowlark just out of nest

- in bloom: Salix interior, Astragalus bisulcatus, A. agrestis, A. tenellus, Antennaria aprica, Thermopsis rhombifolia, Erysimum inconspicuum, Allium textile, Zigadenus venenosus, Castilleja lutescens, Hedysarum, Sisyrinchium, Elaeagnus commutata, Potentilla concinna, Penstemon procerus (almost blooming), Cerastium arvense, Linum lewisii, Lonicera dioica, Achillea millefolium, Galium boreale, Lappula, Anemone canadensis, Penstemon nitidus, Lomatium foeniculaceum, Ranunculus cymbalaria, Zizia aptera, Agoseris glauca

Aspen wood creek crossing
- singing: Brown Thrasher, Clay-colored Sparrow, Least Flycatcher, Savannah Sparrow, LeConte's Sparrow
- flying over: American Crow, Barn Swallow
- Vesper Sparrow nest on slope
- in bloom: Stellaria longipes, Moehringia lateriflora, Fragaria, Hedysarum alpinum, Psoralea esculenta (1 on dry slope), Oxytopis sericea, Rosa, Viola adunca, Sisyrinchium, Linum lewisii, Erysimum inconspicuum, Astragalus bisulcatus, Arabis hirsuta (also in grazed grassland), Zizia aptera, Cerastium arvense, Senecio canus, Astragalus

drummondii, A. missouriensis

Lush grassland
- singing: several Baird's Sparrow, several Western Meadowlark, Sprague's Pipit

Coulees south Willow Creek just outside study area
- singing: several Least Flycatcher, Alder Flycatcher, several House Wren, several Gray Catbird, several Brown Thrasher, 2 Red-eyed Vireo, 2 Warbling Vireo, several Yellow Warbler, Red-winged Blackbird, several N. Oriole, American Goldfinch, Rufous-sided Towhee, Clay-colored Sparrow, Savannah Sparrow, Rock Wren
- Common Nighthawk, Great-horned Owl, 3 Swainson's Hawk, Red-tailed Hawk and nest, pr. Mallard, pr. Gadwall, pr. Killdeer, pr. Spotted Sandpiper, Mourning Dove, Eastern Kingbird, Black-billed Magpie, Am. Crow, Black-capped Chickadee (nest with young), Am. Robin, Mountain Bluebird, Brewer's Blackbird, Brown-headed Cowbird
- flying over: Tree Swallow, 2 Rough-winged Swallow
- 4 Least Chipmunk, 7 Mule Deer
- Chorus Frogs calling
- Tiger Swallowtail, Ringlet, Alpine sp., Blue spp., small Boloria-like sp.; Dusky-wing skipper sp.

Ungrazed mixed grassland
- singing: Baird's Sparrow, Vesper Sparrow (nearby), Horned Lark (nearby), W. Meadowlark
- flying over: Am. Kestrel, Barn Swallow, white-headed gull sp., Say's Phoebe

- in bloom: Fragaria, Moehringia, Viola canadensis, Potentilla anserina, Senecio canus, Anemone multifida, Astragalus spp., Hedysarum alpinum, Actaea rubra, Smilacina racemosa (finished), yellow Oxytropis sp., Lonicera dioica, Dodecatheon (finished), Cerastium arvense, Zizia aptera, Arabis hirsuta, Carex sprengelii, Comandra, Allium textile

Grazed grassland
- 4 Coyote, 19 Pronghorn

Large pond
- Willet, 2 M. Godwit, pr. Baldpate, 50+ ducks

Gravel pit
- Thermopsis still blooming well

June 13
End of hook road at SE end study area
- singing: Rock Wren (conglomerate outcrops), numerous Vesper Sparrow, Clay-colored Sparrow, Sprague's Pipit (in distance), Baird's Sparrow (in distance)
- Vesper Sparrow nest with eggs on slope, Brewer's Blackbird, Killdeer (by water hole), Brown-headed Cowbird
- flying over: 2 Sandhill Crane (came low over hill then soared high off to the WNW), Ferruginous Hawk, Swainson's Hawk, Pine Siskins, Cedar Waxwings

- in bloom in grazed coulee bottoms: Astragalus dasyglottis, Antennaria aprica, Arnica fulgens, Geum triflorum, Zigadenus venenosus

Shrub communities in shallow coulee N. gravel pit and hook road
- undisturbed and lush
- Clay-colored Sparrow, Yellow Warbler, Brown Thrasher (shrub-ringed pond)

Fescue grassland just east of above habitat, east of fenceline
- very lush; no sign of grazing, just mowing
- singing: numerous Baird's Sparrow, Sprague's Pipit, Savannah Sparrow (in low drainage)
- Savannah Sparrow nest with eggs

Coulees south of corrals
- woodland in farthest south coulees mostly disturbed through cattle use; most undisturbed coulee is farthest north
- singing: Warbling Vireo, Red-eyed Vireo, Brown Thrasher, Gray Catbird, Rufous-sided Towhee, Least Flycatcher, House Wren, Yellow Warbler, American Goldfinch, Northern Oriole

June 20, 1984
Aspen clones in fescue grassland, NE corner study area
- clones west of north-south road in poor condition, because of cattle disturbance, compared with clones east of road, in a mowed field with no recent grazing. Bird populations seemed higher and more diverse in west clones, perhaps because a lot of trees were still standing and damaged but not yet dead. Undergrowth in west clones was almost nil and some bird species therefore were likely not able to nest.
- birds: Loggerhead Shrike (just N. study area), Ferruginous Hawk (flying towards west clones from NE corner of study area), Least Flycatcher (both sides), Black-billed Magpie (W. side), A. Crow (W. side), 3 Red-breasted Nuthatch (1 and 2 in different clones, E. side), House Wren (both sides), Warbling Vireo (W. side), Red-eyed Vireo (W. side), Yellow Warbler (W. side), Clay-colored Sparrow (W. side in willow clumps), N. Oriole (W. side), Great-horned Owl (W. side but no likely nests found on either side), W. Meadowlark (W. side), Upland Sandpiper (flying from W. to E. side)
- extensive but linear lush herb communities following drainage between 2 lines of aspen clones, on E. side, including a few lilies in bloom

August 16, 1984
NE corner Little Fish Lake SA
1 Marsh Hawk, Hieracium umbellatum in fescue, yellow paintbrush, Heuchera rich., Lilium phil. in snow patch area, Solidago missouriensis;

Plot 1 - aspen WT Deer, nest could have been used by Merlins
P. tremuloides - Bromus inermis woods
slight SE facing slope, less than 5%, mesic, moderately well, depression, slow change, smooth, deadfall 5%, humus 30%, tree cover P. Trem. 75%+, 6-7 metre, 10-15cm, some regen 1.5 m 15-25%
shrub - Symphoricarpos occ, Rosa woodsii less than 5%, some Ribes oxy.,

choke cherry, mostly buckbrush grass - Bromus inermis 75% (almost exclusively)
forbs - less than 5%; Smilacina stellata 2-5, Thalictrum ven. clone is expanding into fescue not well in this dry year
Grasslands by clone - Erigeron glabellus blooms, Potentilla gracilis and arguta in denser herb patches

Plot 2 - lush forb patches edge of aspen clone
no woody species - Rosa woodsii present
graminoid - 50-75%, mostly fescue 25%, 5-15% Stipa curtiseta, Poa interior, Muhlenbergia, some Agrostis, Agropyron subsec.
forb - 25-50%, primarily Galium boreale 15-25%, shot 5, rest 2-5% - Campanula rot., Potentilla arguta, Potentilla gracilis, Erigeron glabellus, Aster ericoides, Anemone patens (5-15%?), Geum triflorum, Tragopogon dubius, Artemisia frigida, Artemisia ludo (5-15%), Geum may be 5-15% also, Heuchera, Solidago missouriensis, Hedysarum alpinum locally clumped with Linum lewisii, Castilleja, Achillea millefolium 1 fritillary, Aster laevis present, Gentianella amarella+, herb cover could be 50-75%, Thermopsis rhombifolia 1, Vicia americana 1, Hieracium +, Gaillardia +, Sisyrinchium +

Solidago canadensis and Ag subsecundum do best around edge of aspen and Bebb willow, Danthonia intermedia also, also Stipa viridula; Anemone cylindrica also, shot of general one, Lilium philadelphicum at edge also, Oxytropis in depressions and Helictotrichon clumpy in areas where more forb growth, also Cerastium arvense, buckbrush creeping in in depressions

Galium boreale, Thermopsis, Hedysarum and Carex siccata with buckbrush, solid carpet of Carex praticola also Thalictrum ven, and Solidago canadensis, Silene drummondii in fescue, no. of lilies in depressions and Helianthus subrhomboideus, Aster laevis in depressions with heart-leaved Alexanders, Zigadenus venenosus and fireweed and Poa interior in depressions also Hieracium and Erigeron glabellus, Arnica

exposed - Astragalus striatus, Erigeron caespitosus, Lygosdesmia, notable changes in grasslands that are heavily grazed (extreme NE) - shot; increase in Stipa, Koeleria (esp.), Erigeron caesp, Aster ericoides, Artemisia frigida, Thermopsis rhomb, Solidago missouriensis, Antennaria aprica, don't get lush fescue forbs like Hedysarum, Lilies, do get some paintbrush, owl clover and yarrow, fescue all but eliminated, Heterotheca villosa trend to mixed grassland, also Anemone multifida, Eastern Kingbird calling over hill, aspen clone completely denuded, Arabis, Erysimum incon, Gaillardia aristata, Geum tri, Artemisia ludovic (not abundant), Anemone patens, Hairy Woodpecker in grazed clone

Arabis divaricarpa in fescue

northern boundary heading west of road - still enough fescue species around but progressing towards mixed type like NE corner, jackrabbit in clones, magpie in one of clones,

good fescue - lots of Poa interior and Stipa curtiseta (past

disturbance?), Sprague's Pipit, we are west of heavy grazed, deer bedding areas in clones; dense brome understory in clones, dense patch of Amanita mushrooms,

Arabis holboellii in fescue; Merlin and dark phase Swainson's along north end, near edge of escarpment by aspen clones.; small flock 10-12 Black Terns heading to LFL; Liatris in bloom in fescue, ground squirrels in lightly grazed in fescue in heavily grazed patches in NW, Shot 11-22 in excellent fescue along north; 23 is fenceline contrast of light and ungrazed fescue; 24-26 escarpment edge

dense patches of Fragaria and Geum on north slope, Solidago spathulata, Zizia, Artemisia campestris, Aster laevis at edge of aspen

Plot 3 - aspen - dense understory of saskatoon 75%+, aspen 75%+, little in understory, Symphoricarpos albus, Rosa woodsii, Ribes oxy., 10% forbs, Aster laevis, Fragaria, Heuchera, shot 27 in clone, Smilacina stellata, Swainson's Hawk, Thalictrum venulosum, Potentilla arguta, rose and buckbrush willow sprouting

Plot 4 - dense silverberry 75%+, understory mostly AG subsec. 50-75%, yarrow and buckbrush also with Aster laevis and Rosa woodsii buckbrush very dense locally 50-75%, rose 5-15%, Ag subsec dense only at edge. buckbrush in centre, sow thistle and nettles, shot 30. some Artemisia ludoviciana

Brown Thrasher in silverberry

Haplopappus spinulosus, Erysimum inconspicuum in fescue with S. Pipit

seepage - collomia, gumweed, foxtail, broomweed, Poa arida, Suaeda depressa, Distichlis stricta, small white asters, Ranunculus cymb, shot

Plot 5 - Hordeum alkali seep
25-50% bare, cattle use, 50% graminoid mostly Hordeum, 3 square rush, forbs 2-5% small asters, Triglochin maritima, some spartina, some Puccinellia, some gumweed locally abundant, Haplopappus lanceolatus, Iva axillaris, good spot for katydids, grasshoppers, Astragalus bisulcatus at edge, Puccinellia in drier sites; Juncus balticus, Opuntia fragilis at edge, Atriplex nuttallii, Iva, Bouteloua, Artemisia frigida, Artemisia longifolia (little badlands), sparse Distichlis stricta and A. longifolia in badlands, odd Iva axillaris, Muhlenbergia collected, Agropyron smithii,

Silene drummondii in silverberry Amelanchier, Stipa favored over fescue in lightly grazed areas also Carex, Danthonia likes draws, collected Astragalus flexuosus, crocus in bloom, Potentilla hippiana in lightly grazed also Selaginella, Silene also, good numbers of Vesper Sparrows along road in shrub patches, silverberry, Swainson's hawk and meadowlark

- going east at edge of grazed and mowed, hole in badland with porcupine scat; 400+ Crows roosting in aspen with smaller flock of Starlings; RT

Hawk on fence between, M. Dove flying

southern section towards coulees - 2 Meadowlarks, Merlin by clones in NE

August 17
- northeast corner
snake under tent; Pine Siskins in aspen clones, same understory - Bromus, Chickadee and SS Hawk in aspen, depression heading to big fireweed patch in ne corner - collected plants - Lactuca pulchella, Agoseris glauca, Gaillardia, fireweed patch is Solidago canadensis and fireweed, Red Crossbill over, Merlin, couple of Meadowlarks

Shot 16-17 Roll 3 - extremely heavy grazed north of cultivated field

Plot 6 - Carex atherodes marsh - 75% C. atherodes in centre; up to 25% Polygonum amphibium at edge, Salix petiolaris ring, Stachys, Rumex, Mentha, Carex arthrostachya, Collomia, foxtail in drier, Agrostis, Red Crossbill imm male, YR Warbler, ungrazed
Barn Swallows and CC Sparrows at C. atherodes

need different lease for mowing/grazing?- grazing affects more fescue plants than mowing does.

moderately heavy to heavy grazed Shot 20-21 near lake
Red Crossbills over, 23 is ground shot

increase in pasture sage, june grass, stipa, groundsquirrels more abundant with coyote, Swainsons Hawk and Marsh Hawk, this is area which was heavily grazed and fescue has come back

Plot 7 - clay pan area - blowouts over 50% bare ground , mostly Koeleria, Hordeum 25-50%, gumweed 5-15%, Heterotheca villosa, Polygonum, Prairie Falcon over, lots of Pasture sage in better sites (15%), some Distichlis, Bouteloua, mostly june grass, Poa sandbergii, Antennaria aprica in clumps, some Agropyron smithii, extremely heavy grazed, soil not conducive to fescue, another coyote

- southeast of corrals along fenceline
comparing recovering area and newly grazed - shots
wild tomato in recovering; mostly Stipa in recovering, newly grazed is mostly fescue

coulee - E. Kingbirds, RT Hawk; hillsides with Shepherdia Salix and buckbrush and silverberry communities

Plot 8 - Shot 27 - Shepherdia community - 50% Sheph can. understory is Juniperus horizontalis 25%, 25-50% graminoid Poa interior, Helictotrichon, ag subscundum and trach. (5-15%), herb cover 25-50% mostly Fragaria and Geum triflorum, also some Rosa woodsii +, red osier regen+, forbs present - Lilium philad., Zigadenus elegans and venenosus, Aster laevis, Linum lewisii, Smilacina stellata, good amount of Lilium, Vicia amer., Hedysarum alpinum, Solidago spathul., Zizia aptera, Achillea, Anemone patens and multifida, young saskatoon, Antenaria aprica, Gaillardia aristata, common juniper, Artemisia

frigida, Rosa woodsii, Galium boreale, Castilleja, Muhlenbergia, Sisyrinchium, Thermopsis, BC Chickadee

Plot 9 - Salix bebbiana community - understory mostly rose, red osier buckbrush snowberry, Thalictrum venulosum, Fragaria, Zizia, Achillea, Smilacina, Vicia americana, 25-50% shrubs, also rose, Arenaria, 15-25% herbs, 50-75% bare ground lots of cattle, Carex sprengellii, Ag. subsec/trach, Hedysarum alpinum, 3-5m willow, Geum allepicum

- creek Equisetum laevigatum, Juncus longistylis, Canada anemone, western willow aster as well as Glyceria, mint, buttercups, Viola adunca, water hemlock, big dock occidentalis, Cirsium flodmanii, Juncus bufonius, Vesper Sparrows, Melissa blue, Common Wood Nymphs, golden sedge, mealy primrose and Beckmannia, CC Sparrows in silverberry sing, Goldfinch

Plot 10 - Silverberry comm - 75% shrub half buckbrush half silverberry, some Rosa woodsii, Ribes oxy and saskatoon, some willow, shot 29 understory sedges 15-25% forbs, mule deer female, hairy nodding brome, Carex sprengellii, Geum allepicum, Thalictrum, Fragaria, Hackelia am., Agropyron sub (major), Poa interior, Bromus inermis, Urtica, Solidago canadensis, Achillea millefolium, lots of dandelions, Aster laevis,

GH Owl feather in aspen clone

Plot 11 - fair amount of cattle use in aspen - 8 cm 8-10 metres relatively sparse understory - 50% bare ground 15% deadfall 15% humus mostly shrubs under, snowberry, ribes oxy, rosa woodsii, red osier shrubs 25-50% shot 30, mostly snowberry
15-25% grass mostly Ag trach, Abietinella
15-25% forb mostly Galium boreale, also Fragaria, Lonicera dioica, Hedysarum alpinum, yarrow, Vicia am, common juniper, Aster ciliolatus, Aster laevis, Arenaria, Geum triflorum, june grass, heart leaved Alex. bearberry, Androsace, Hieracium, Smilacina, Juniperus horizontalis at upper edge, Ag. dasy in recovering

Astragalus drummondii in fescue in bowl, some of slopes get more stipa, young goldfinch, Glycyrrhiza in shrub, Ribes americanum ST Grouse, Waxwing, stands of chokecherry, mule deer, couple of young ST Grouse, lots of raspberry, gooseberry, Disporum trachy, Canada anemone, Rosa woodsii, Solidago can., red osier, principally choke cherry over, some saskatoon, Geum allepicum, baneberry, Urtica, Lathyrus ochroleucus, E. Kingbird, 13 line GS, rose saskatoon buckbrush mid slope, shepherdia higher up, Eriogonum along edge of exposed rocky, 32 shot of bowl

Comandra pallida along edge

heading east along drainage to lake - 2 coyotes

NW end of Little Fish - 20 C. Geese, 10 Cormorants, few sandpiper, shorebirds on rocky point

conglomerate - blue beard tongue, Cirsium undulatum, Senecio canus on rocky sites, Erigeron compositus, Paronychia, Chamaerhodos, Artemisia

campestris, Opuntia poly, Calamovilfa, Polygonum coll, Chrysopis villosa, Eriogonum flavum, end of roll 3, Prairie Falcon over northern conglomerate,

Upland Sandpiper heavy grazed

Roll 4 shot 6 is heavy grazed around slough, pond north of coulee is Great Blue Heron and GW Teal, Gadwall family,

Plot 12 - Stipa grassland by willows - Elaeagnus
principally Stipa curtiseta - cover of 75% little else - Astragalus flex
Artemisia frigida, Potentilla pensy, Koeleria cristata, small clumps fescue, Cerastium arvense, Art. frig. (2--5%), some Selaginella densa, some Anemone patens, Heterotheca villosa, small patches of Bouteloua in grazed, some Calamovilfa, some Carex, Elaeganus in area, some Helictotrichon, Poa interior

Roll 4 Shot 11 - old Ferruginous nest on coulee behind maybe one on fence, fenceline shot

- coulee at nw part where aspen clone
E. Kingbird along coulee, solid cover of Juncus balticus, sedge, sonchus, lots of western willow aster, some Puccinellia, Triglochin, Glyceria, Iva axillaris, Deschampsia,

RW Swallow by beaver dam, also Vesper Sparrow and E. Kingbird.

October 13

NW shore of lake
- flock of several hundred Snow Geese along section of shoreline not disturbed by cattle
East side study area, mostly in vicinity of gravel pit
- migrating south during 2 hr. period: 2 Bald Eagle (ad. + imm.), N. Harrier, Sharp-shinned Hawk, 2 Cooper's Hawk, 15 Red-tailed Hawk (incl. a few Harlan's), 8 Rough-legged Hawk, Am. Kestrel

APPENDIX 7: TERMS OF REFERENCE

Attached is a copy of the terms of reference under which this study was conducted.

SCHEDULE "A"

TERMS OF REFERENCE FOR VEGETATION, FLORA, AND SPECIAL FEATURES OF THE PROPOSED LITTLE FISH LAKE ECOLOGICAL RESERVE

1. INTRODUCTION

The Little Fish Lake area has been recommended as a major ecological reserve to represent the Northern Fescue Grasslands biogeographical section. However, little baseline data is available for this site.

Information on the representative and special features of the Little Fish Lake area is required. This information will be used to evaluate the suitability of the site for ecological reserve status. Should the site become established as an Ecological Reserve, this data will also be used in preparation for the development of a management plan for the area. A detailed vegetation map, a special features map and an accompanying report will be required.

2. PURPOSE

General:

To identify the resource features that occur within the proposed Little Fish Lake Ecological Reserve that are both special within and representative of the Northern Fescue Grassland biogeographical section. To produce a vegetation map, a special features map and an accompanying descriptive report. To identify features of the Northern Fescue Grassland not present within the proposed Little Fish Lake Ecological Reserve.

Specific:

1. produce a draft map of the major vegetation types at a scale of 1:15 000 on mylar
2. produce a draft map of the special features at a scale of 1:15 000 on mylar
3. provide an annotated vascular floral species list
4. provide a labelled and unmounted collection of the uncommon and rare vascular flora
5. provide a labelled collection of non-vascular flora
6. provide a complete set of field data sheets (see attached example) for the vegetation plots examined

7. provide an annotated list of faunal species noted

8. provide accompanying descriptive report including a discussion of the area's suitability as an ecological reserve representing the Northern Fescue Grassland

9. determine features of the Northern Fescue Grassland not represented within the Little Fish Lake area

3. DEFINITIONS

1. Special features may include but not be limited to:

   - excellent or "classic" examples of geomorphic features or vegetation types
   - rare or unusual physical or biological features
   - areas of exceptional biophysical diversity
   - important faunal habitats
   - areas particularly sensitive to disturbance

2. Representative features include physical or biological features common to the biogeographical section.

3. Rare or uncommon plants include those species listed in "A Checklist of the Rare Vascular Plants of Alberta with Maps" (J. G. Packer and C. Bradley 1978).

4. Final Draft Report refers to a typed or written report that is submitted for professional and editorial comment and that in content, structure and quality conforms to Alberta Energy and Natural Resources standards for a departmental publication (see Creating a Technical Report, Alberta Energy and Natural Resources). See attachment.

5. Final Report refers to the corrected version of the Final Draft Report and should be fully satisfactory to the Minister.

4. PROJECT AREA

The area includes the 7 770 ha (30 sq.mi.) proposed ecological reserve. The lands included are Twp. 28 - Rge. 17 - W4: Sections 1-3, 10-12, 13-36 (see attached map).

5. MAPPING REQUIREMENTS

The maps will be prepared using aerial photograph interpretation and ground truthing.

The maps will be prepared on mylar and be professionally adequate in presentation and quality that they could, at the discretion of the Natural Areas Co-ordinator, be easily redrafted by professional cartographers/draftsmen using provincial base maps.

6. FIELD REQUIREMENTS

Based on preliminary aerial photograph interpretation, the contractor will conduct fieldwork between May 15 and August 30, 1984. The timing of fieldwork is at the consultant's discretion but will consider phenologies of the biological resources involved. Specifically but not limited to flowering plants and nesting birds.

The methodologies for vegetation typing in the field are at the consultant's discretion, but must be sufficiently rigorous and comprehensive to allow documented description of the full range of plant communities within a vegetation mapping unit.

7. REPORT REQUIREMENTS

The report will include a description of the study area, based on literature reviews, and may include such topics as bedrock and surficial geology, climate, soils, fauna, etc.

The report will contain all pertinent information regarding descriptions of the vegetation types found and mapped in the study area. This information will include but not be limited to a list of dominant as well as characteristic plant species for each type, a description of the physical parameters which characterize the type, and a description of the range of diversity of stands which the consultant recognized as occurring within each type.

The consultant will compare the vegetation with those described in the literature for other areas in the Grassland Regions of Alberta.

8. LOGISTIC SUPPORT

The consultant will supply all material and equipment required for completion of the study, with the exception of:

- provincial base maps (1:15 000) for mapping of vegetation and special features
- mylar

- film
- aerial photographs
- typing service
- identification of the vascular and non-vascular flora
- blank field data sheets

9. COMPLETION SCHEDULE

The consultant shall submit:

1. a field itinerary no later than June 15, 1984.
2. a final draft report and maps no later than November 30, 1984 (see DEFINITIONS).
3. a final report and maps no later than January 31, 1985 (see DEFINITIONS).

10. LIAISON

The consultant shall maintain a close liaison with Natural Areas Program staff, and shall arrange for the work to be reviewed and/or discussed at critical points in the project. At a minimum, this will include a review following the completion of each phase of the project as in Section 9 above.

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